

# **PHASE 5 SUPPLEMENTAL INVESTIGATION RESULTS OF PUMPING TESTS**

**GREGORY CANYON LANDFILL  
SAN DIEGO COUNTY, CALIFORNIA**

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**PHASE 5 SUPPLEMENTAL INVESTIGATION  
RESULTS OF PUMPING TESTS  
PROPOSED GREGORY CANYON LANDFILL**

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## **1.0 INTRODUCTION**

This report presents the results of aquifer tests conducted recently to evaluate the hydraulic properties of the bedrock aquifer in Gregory Canyon. The tests were performed from November 27, 2000 to December 1, 2000 and consisted of two pumping tests completed in conjunction with both near and far field observation wells. The results of the tests were incorporated in MODFLOW analyses of local groundwater conditions. The pumping tests and the MODFLOW analyses support the design of the subdrain system proposed for the Gregory Canyon Landfill.

## **2.0 GROUNDWATER FLOW SYSTEM**

The prevailing observation of this and previous studies is that the groundwater flow system in Gregory Canyon can be characterized as a fracture-controlled unconfined aquifer that on a macroscopic scale simulates porous media conditions. Figure 1 presents a schematic model of this type of groundwater flow system; a system in groundwater flow in the fractured bedrock is subparallel to the slope gradient. This fracture-controlled groundwater communicates with, and recharges the alluvial water table of the San Luis Rey Valley. The fractured bedrock flow system can be differentiated into an upper zone of active flow through a relatively dense network of interconnected fractures, and a deeper zone of relatively low flow through more widely spaced fractures. The aquifer within the lower zone will be limited by the local extent of water-bearing fractures.

Both a water table and a piezometric surface describe the occurrence of groundwater in the illustrated system. A piezometric surface represents the potential water table above any point in the subsurface. The 'dry well' shown in Figure 1 illustrates a case where no water-bearing fractures are encountered in the screened interval, thus no water is produced in the well, although the well access does lie below the potential groundwater surface.

## **3.0 PUMPING TESTS**

The pumping tests were completed using an electric submersible pump to discharge groundwater from monitoring wells GLA-3 (Test 1) and GLA-8 (Test 2). Calibrated pressure transducers were placed in both the pumping wells and nearby observation wells and these transducers were connected to a computerized data logger positioned at the ground surface. Far field wells were also instrumented with remote data recorders (trolls). Groundwater level response to pumping was then measured and recorded. Test setup and equipment specifications are presented in Table D-1 (Appendix D).

Pumping test data are included in Appendices A, B, and C, and are summarized in Table 1; well locations are shown on Plate 1. Wells involved in the tests are identified below.

	TEST 1	TEST 2
Pumping Wells	GLA-3	GLA-8
Observation (Near Field) Wells	GMW-1	GMW-4
	GMW-13	
Far Field Wells	GLA-4	GLA-4
	GLA-5	GLA-5
	GLA-11	GLA-11

Test 1 was conducted for approximately 27 hours at a constant pumping rate of 10.0 gpm. Approximately 10 feet of drawdown was observed in pumping well GLA-3. Drawdown of nearly 5 feet and 2 feet respectively was measured in the observation wells GMW-1 (at a distance of 51 feet) and GLA-13 (at a distance of 200 feet). No measurable drawdown was measured in the far field wells as a part of this pumping test.

Test 2 was conducted for approximately 24 hours at a constant pumping rate of 2.0 gpm. Approximately 48 feet of drawdown was observed in the pumping well GLA-8. Drawdown of approximately 18 feet was observed in the observation well GMW-4 (at a distance of 21 feet). No measurable drawdown was measured in the far field wells as a part of this pumping test.

Time-drawdown, and distance-drawdown curves for each well, or well combination, are included in Appendix A for Test 1, and in Appendix B for Test 2. Hydraulic conductivity and transmissivity were calculated by the Cooper-Jacob and Theis standard methods using the software program AquiferTest. Values for these parameters differed little whether a confined or unconfined condition was assumed (Table 1).

Far field wells were instrumented with remote data recorders (trolls) and data was recorded continuously starting several days before the pumping tests and continuously for several days after test completion. Time-drawdown plots are included in Appendix C.

Hydrogeologic sections for each pumping test are presented in Figure 2 and illustrate the physical environment of the wells and test. In general, the tests indicate the wells are in hydraulic communication in the near field environment (approximately 200 foot radius; Plate 1). The far field wells (minimum 1400-foot radius; Plate 1), however, show no systematic fluctuations in water levels related to the pumping tests. Rather, the observed far field fluctuations are correlative between wells and are due mainly to diurnal temperature and atmospheric pressure variation.

The results of Test 1 are presented in Appendix A and Table 1. Test data were analyzed using the Cooper-Jacob and Theis time-drawdown methods for unconfined and confined conditions. Similar results were obtained for both conditions, but the unconfined condition is considered reflective of the actual aquifer at the test site. As shown in Figure 2, pumping well GLA-3 and observation well GMW-1 are cased into bedrock but penetrate both the alluvial and bedrock aquifers, whereas observation well GLA-13 penetrates only the bedrock aquifer. The water level in GLA-3 was drawdown below

the base of the alluvium, with accompanying drawdown in the observation wells, indicating hydraulic communication between the water-bearing alluvium and fractured bedrock, and through the water-bearing fractured bedrock between wells.

The Cooper-Jacob curves for GLA-3 and GMW-1 (Appendix A) are similar in indicating an effect equivalent to well storage at early pumping times (less than 10 minutes). This is believed due to storage adjacent to the casing in either a damaged zone or annular space. At longer pumping times, steady drawdown at similar rates was achieved in both wells. Hydraulic conductivity estimated by these analyses is approximately  $4.6\text{E-}03$  ft/min. Measurable drawdown in observation well GLA-13 occurred at approximately 10 minutes pumping time, coincident with the end of the storage effect in the other wells of Test 1. Hydraulic conductivity estimated by analysis of this well data is approximately  $1.3\text{E-}02$  ft/min. The Cooper-Jacob curve indicates a higher rate of drawdown in GLA-13, and continuous steepening of the drawdown curve at longer pumping times, suggesting that the bedrock aquifer is limited. This effect is not observed in GLA-3 and GMW-1, probably because the alluvial portion of the aquifer recharges the fractured rock portion of the aquifer.

Distance-drawdown analyses (Appendix A) estimate average hydraulic conductivity at approximately  $2.6\text{E-}03$  ft/min and the distance-drawdown curve indicates a radius of influence for well GLA-3 of approximately 1000 feet when pumping at 10 gpm.

Bedrock transmissivity values were derived from the computed hydraulic conductivity values, and aquifer thickness estimates, based in part on well tests by COLOG presented in the Phase 5, Hydrogeologic Report (GLA, 1997). Aquifer thickness in GLA-3 is estimated to be 60 feet, representing the vertical distance between the bedrock contact with alluvium and the deepest extent of the producing zone defined by tracer tests. Similarly, in GMW-1 aquifer thickness is estimated to be 52 feet. In GLA-13 aquifer thickness is estimated to be approximately 15 feet representing the vertical distance between the water table and the bottom of the well. Applying these estimates results in a range of transmissivity values between  $9.5\text{E-}02$  ft<sup>2</sup>/min to  $2.8\text{E-}01$  ft<sup>2</sup>/min (Table 1).

The results of Test 2 are presented in Appendix B and Table 1. Test data were analyzed using the Cooper-Jacob and Theis time-drawdown methods for unconfined and confined conditions. Similar results were obtained for both conditions which are reported in Table 1, but the unconfined condition is considered reflective of the actual aquifer at the test site. As shown in Figure 2, pumping well GLA-8 and observation well GMW-4 penetrate the bedrock aquifer to depths of 300 feet and 120 feet, respectively. The water level in GLA-8 was drawdown below the bottom of GMW-4 with accompanying drawdown in the observation well, indicating hydraulic communication between wells through the water-bearing fractured bedrock. Note that in contrast to GLA-3 at the location of Test 1, groundwater occurs at this location below the zone of weathering.

The Cooper-Jacob curves for (Appendix B) indicate relatively steady drawdown in GLA-8 at pumping times greater than 1 minute, and in GMW-4 at times greater than 10 minutes. For both wells steepening of the time drawdown curves at relatively longer

pumping times indicates a limited aquifer condition. Hydraulic conductivity estimated by analyses of GLA-8 is approximately  $6.2\text{E-}05$  ft/min for earlier times and  $1.1\text{E-}05$  ft/min for longer times. Similarly, hydraulic conductivity estimated by analysis of GMW-4 is approximately  $3.4\text{E-}04$  ft/min and  $2.1\text{E-}04$  ft/min, respectively.

Distance-drawdown analyses (Appendix B) estimate similar hydraulic conductivity values at similar pumping times as in the time-drawdown analyses. The distance-drawdown curve indicates the radius of influence of well GLA-8 is approximately 250 feet when pumping at 2 gpm. However, as the time-drawdown extrapolation in Figure 3 shows, GLA-8 could be pumped dry (i.e., drawdown below its lower producing zone) in less than two weeks. The level of drawdown in the pumping well would correspond to about 30 feet of drawdown in GMW-4. This condition plotted on the distance-drawdown graph of Figure 3 suggests the radius of influence of GLA-8 may be less than 100 feet owing to the limited aquifer condition.

Bedrock transmissivity values were derived from the computed hydraulic conductivity values, and aquifer thickness estimates based in part on well tests by COLOG presented in the Phase 5, Hydrogeologic Investigation Report (GLA, 1997). Aquifer thickness in GLA-8 is estimated to be 108 feet, representing the vertical distance between the piezometric surface and the deepest extent of the producing zone defined by tracer tests. In GMW-4 aquifer thickness is estimated to be 48 feet representing the vertical distance between the water table and the bottom of the well. Applying these estimates results in a range of early and late transmissivity values between  $1.2\text{E-}02$  ft<sup>2</sup>/min to  $8.7\text{E-}04$  ft<sup>2</sup>/min (Table 1).

Hydraulic conductivity values from the results of Test 2 were selected for use in MODFLOW analysis because these values represent the unadulterated response of the bedrock aquifer to well drawdown in the central portion of Gregory Canyon in close proximity to the deepest proposed excavation. At GLA-8 hydraulic conductivity is estimated to be approximately  $6.2\text{E-}05$  ft/min ( $0.09$  ft/day) for earlier times, and  $1.1\text{E-}05$  ft/min ( $0.015$  ft/day) for longer times.

#### 4.0 SEEPAGE ANALYSIS

Given the results of Test 2, the maximum total transient inflow to the bedrock excavation can be numerically estimated from the relation,

$$Q = Tw(dh/dl).$$

Where  $Q$  is inflow in ft<sup>3</sup>/day,  $T$  is the transmissivity for an aquifer thickness of 108 feet ( $6.72 \times 10^{-3}$  ft<sup>2</sup>/min =  $9.68$  ft<sup>2</sup>/day; from Table 1),  $w$  is the length of the drainage face (approximately 6000 ft), and  $(dh/dl)$  is the hydraulic gradient (average value =  $0.20$ ). If it were assumed that inflow would occur initially over the entire cut face (Plate 1), and that the cut is vertical and could be made instantaneously, the resulting (worst case)  $Q$  is  $1.2\text{E}04$  ft<sup>3</sup>/day, or approximately 87,000 gpd.

The assumption of an instantaneous excavation is, of course, overly conservative, because the proposed excavation will be done in stages spanning several years. Given the practical timing of excavation as the development proceeds up-canyon, exposing a progressively greater seepage area below the piezometric surface, drainage will occur incrementally, and the water table (or piezometric surface) will adjust continuously to the newly created base level of the excavation. The above analysis does represent a worst case order of magnitude calculation based on an unrealistic scenario, but it comports well with the MODFLOW analysis, which is derived from different assumptions (Section 5.0 herein).

## **5.0 MODFLOW ANALYSIS**

The modeling described herein (Table 2, Figures 4, 5, and 6) supplements earlier modeling presented in the Phase 5, Hydrogeological Investigation Report (GLA, 1997), and includes use of the hydraulic conductivity values calculated from the pumping tests described in Section 3.0.

Groundwater models summarized herein were developed using the MODFLOW computer program. MODFLOW is a modular, three-dimensional, finite-difference groundwater flow model that uses Darcy's flow equations to calculate groundwater flux through a grid network of model cells. The model consists of a three dimensional array of cells 200 feet wide in the east-west direction, 400 feet wide in the north-south direction and 100 feet thick, shown on Plate 1. A conservative porosity value of 0.01 was applied equally to the entire model domain.

The drainage capacities simulated in the models were evaluated using the MODFLOW "drain package" that removes water from the model in order to maintain water elevations at a user-defined level. For the purposes of this model the volume excavated below the piezometric surface was defined as multiple drain cells with corresponding elevations five feet below the design base of the excavation. The amount of water flowing "into" the model was controlled by use of constant flux nodes, and the flow of water "out" of the model was controlled by the use of constant head and drain nodes. Model calibration consisted of varying the amounts of flux entering the boundary of the model until the calculated head levels were approximately equal to observed head elevations at calibration points across the site.

Hydraulic conductivity values were selected from the results of Test 2 (rather than Test 1) because they represent the unadulterated response of the bedrock aquifer to well drawdown in the central portion of the site. Both relatively early and late test values for hydraulic conductivity can be derived from the time-drawdown curves for the unconfined condition as noted above. The MODFLOW analysis presented here uses the hydraulic conductivity values 0.09 ft/day for initial inflow conditions, and 0.015 ft/day to simulate anticipated long-term operational conditions.

Short-term drainage conditions are presented in models G1/G2, and G3/G4 (Table 2). These models represent instantaneous short-term fluxes that might occur during and shortly after excavation below the piezometric surface, if the excavation could be made instantaneously.

Model G1/G2 is shown in Figure 4 and illustrates the model domain with equipotential lines for the steady state drained condition (after excavation). Because the well tests indicate that little or no water is likely to be produced from depths below about 150 to 200 feet below ground surface, model G1/G2 also utilized a lower hydraulic conductivity value (0.009 ft/day) for cells more than 200 feet below ground surface. Owing to the lower hydraulic conductivity value applied to the bottom portions of the excavation, most of the flux generated in Model G1/G2 is generated from the side walls of the excavation.

Model G3/G4 is shown in Figure 5 and also illustrates the modeled domain with equipotential lines for the short-term drained condition. In model G3/G4 a hydraulic conductivity of 0.09 ft/day was kept constant over the domain of the model. This model also shows a lowering of local groundwater levels in response to excavation of the canyon bottom below the piezometric surface. The flux value for Model G3/G4 is significantly higher than for Model G1/G2 because of the conservative higher hydraulic conductivity applied to the bottom portions of the model. It should be noted that the flux calculated for this condition is consistent with the numerical analysis presented in Section 4.0.

Models G1/G2 and G3/G4 represent worst case estimates of initial groundwater inflow under an assumed instantaneous excavation scenario (see Table 2). Model G5/G6 is shown in Figure 6 and illustrates the modeled domain with equipotential lines for the long-term drained condition; a condition more typical of actual construction and the flux that is estimated to flow into the subdrain of the finished landfill when excavation and liner construction is completed. The long-term drainage condition is presented in model G5/G6 using a hydraulic conductivity value of 0.015 feet/day, which is indicative of conditions from the later stages of the pump test in well GLA-8. As a result of this analysis under operating conditions, peak inflows are anticipated to be approximately 13,000 gal/day (model G5/G6) for the excavation area.

Table 2 also presents the results of MODFLOW analysis reported previously in the Phase 5 Hydrogeologic Investigation Report (GLA, 1997). The model then proposed for subdrain design (Greg 4, 1997) estimated approximately 14,500 gpd for the long-term inflow condition. This result compares favorably with the preferred model G5/G6 based on pumping test results, which estimated a long-term inflow rate of approximately 13,000 gpd.

The groundwater model yielded steady-state hydraulic head configurations that were generally similar to those observed in monitoring wells and model calibration points and the observed hydraulic gradient of 0.2 ft/ft was also calculated. In addition, both observed and modeled groundwater flow is to the north towards the San Luis Rey River.



It should be stressed that the relative changes in hydraulic head values are only valid in the vicinity of the drain cells. The models do not predict hydraulic head changes at the model boundaries.

## 6.0 CONCLUSIONS

On the basis of the aquifer testing and modeling summarized herein, wells within the bedrock aquifer are in hydraulic communication within the radii of the near field observation wells (i.e., on the order of hundreds of feet). In addition, hydraulic conductivity is higher at the Test 1 location, relative to the Test 2 location, probably owing to a deeper weathered zone below the alluvial aquifer. Finally, relatively early and late hydraulic conductivity values estimated from Test 2 are thought to be representative of the bedrock aquifer in the central portion of the site, below the zone of weathering and indicate limited aquifer conditions.

Hydraulic conductivity values estimated from the well test analyses appear to vary locally, but the bulk porosity of the bedrock system is low as suggested by limited aquifer effects seen in bedrock wells in the both pumping tests.

Hydraulic conductivity values noted above from Test 2 were incorporated in MODFLOW analyses to simulate initial and long term potential inflow conditions. Maximum total transient inflow was estimated to be approximately 85,000 gpd by MODFLOW analysis (model G3/G4); essentially the same quantity estimated by seepage calculations based on transmissivity in GLA-8 (Section 4.0). A more realistic, but still conservative model (model G5/G6) allows for transient drainage during construction and yields approximately 13,000 gpd based on a hydraulic conductivity value from late stage pumping of GLA-8. This value compares well with the initial design basis of approximately 14,000 gpd (Phase 5 Hydrogeologic Investigation Report, 1997).

Based of the study summarized herein, it is concluded that the current monitoring and subdrain design basis is appropriate for currently understood site conditions.

## 7.0 CLOSURE

This report has been prepared in accordance with generally accepted geotechnical practices and makes no other warranties, either express or implied, as to the professional advice or data included in it. This report is based on the project as described and the data obtained in the field and the laboratory, or from referenced documents. This report has not been prepared for use by parties or projects other than those named or described herein.

GeoLogic Associates



Gary L. Lass, RG, EG, HG  
President

## **TABLES**

**TABLE 1**  
**SUMMARY OF PUMPING TEST RESULTS**  
**GREGORY CANYON LANDFILL**

Pump Test #1	Well	Distance From Pumping Well (feet)	Aquifer Thickness (feet)	Analytical Method	Data Points	Hydraulic Conductivity (ft/min)	Transmissivity (ft <sup>2</sup> /min)	Storage
Pump Test #1	GLA-3	1	60	Cooper-Jacob, unconfined	late	4.62E-03	2.77E-01	na
		1	na	Cooper-Jacob, confined	late	4.09E-03	2.45E-01	8.87E-08
		1	60	Theis, unconfined	late	2.69E-03	1.61E-01	na
	GMW-1	51	52	Cooper-Jacob, unconfined	late	4.59E-03	2.38E-01	na
		51	na	Cooper-Jacob, confined	late	4.35E-03	2.26E-01	1.28E-04
		51	na	Theis, unconfined	late	4.23E-03	2.20E-01	na
	GLA-13	200	14.5	Cooper-Jacob, unconfined	late	1.33E-02	1.92E-01	na
		200	na	Cooper-Jacob, confined	late	na	1.90E-01	na
		200	14.5	Theis, unconfined	late	1.05E-02	1.52E-01	na
	GLA-3/GMW-1	1, 51	60	Distance-Drawdown, unconfined	t = 1600	3.18E-03	1.91E-01	na
	GLA-3/GLA13	1, 200	60	Distance-Drawdown, unconfined	t = 1600	2.55E-03	1.53E-01	na
	GMW-1/GLA-13	51, 200	52	Distance-Drawdown, unconfined	t = 1600	1.89E-03	9.84E-02	na
	GLA-3, GMW-1, GLA-13	1, 51, 200	60	Distance-Drawdown, unconfined	t = 1600	2.63E-03	1.58E-01	na
Pump Test #2	GLA-8	1	108	Cooper-Jacob, unconfined	late	1.18E-05	1.38E-03	na
		1	na	Cooper-Jacob, confined	late	na	8.68E-04	4.08E-01
		1	108	Cooper-Jacob, unconfined	middle*	6.22E-05	6.72E-03	9.37E-04
	GMW-4	1	na	Cooper-Jacob, confined	middle	na	5.90E-03	7.63E-03
		1	108	Theis, unconfined	mid-late	6.22E-05	6.72E-03	na
		21	46	Cooper-Jacob, unconfined	late	2.06E-04	9.47E-03	na
		21	na	Cooper-Jacob, confined	late	na	8.84E-03	1.00E-03
		21	46	Cooper-Jacob, unconfined	middle	3.41E-04	1.56E-02	na
		21	na	Cooper-Jacob, confined	middle	na	1.62E-02	9.37E-02
	GLA-8/GMW-4	1, 21	na	Theis, unconfined	late	1.46E-04	6.72E-03	na
		1, 21	na	Distance-Drawdown, unconfined	t = 600	1.09E-04	1.18E-02	na
		1, 21	na	Distance-Drawdown, unconfined	t = 1400	5.72E-05	6.18E-03	na

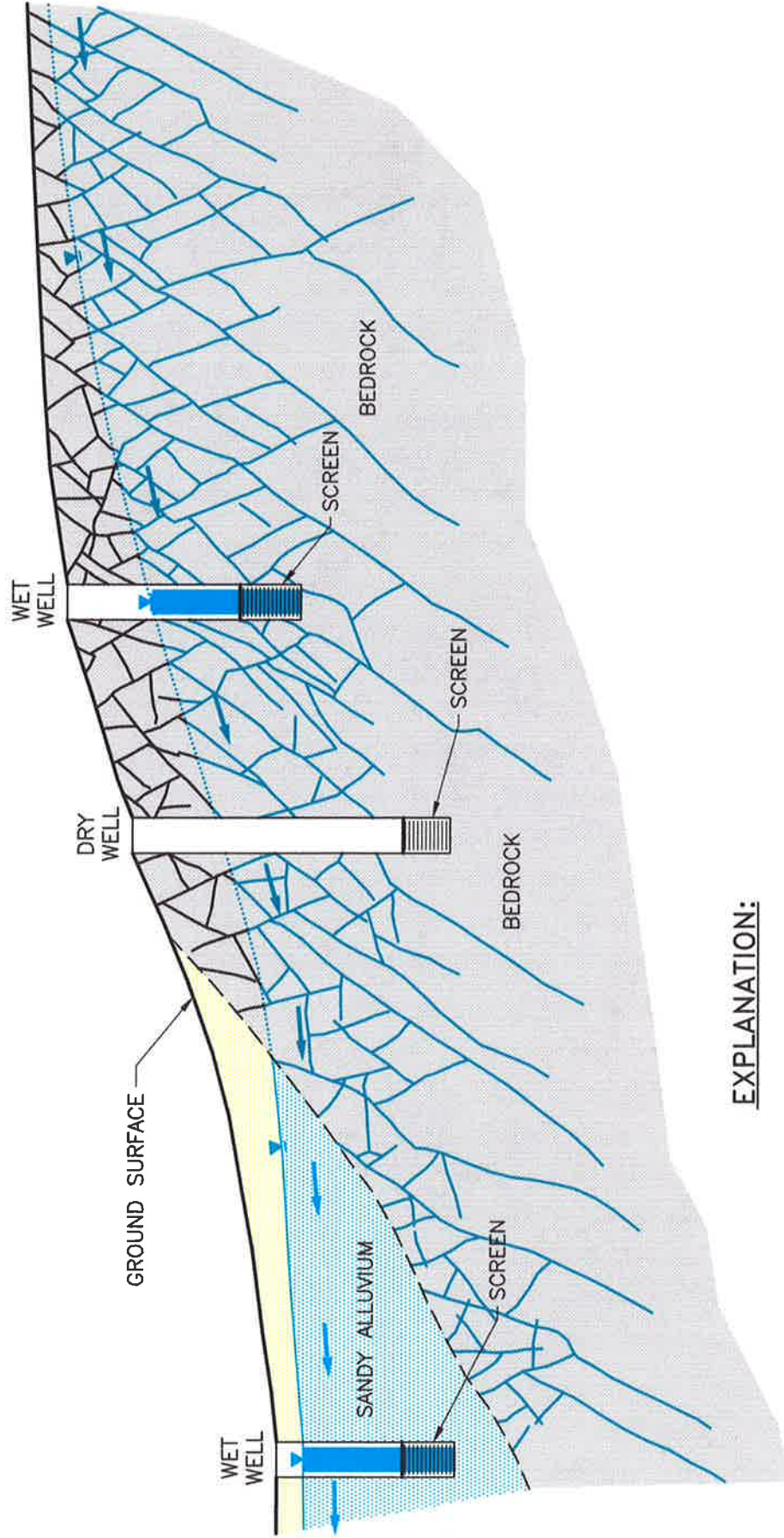
\* Middle data points correspond to early pumping times referred to in text.

**TABLE 2**  
**GREGORY CANYON GROUNDWATER FLOW MODEL**  
**COMPARISON OF MODEFLOW RESULTS**

Model Name	Hydraulic Conductivity (feet/day)		Flux Entering Model (feet <sup>3</sup> /day)	Flux Leaving Model (feet <sup>3</sup> /day)	Mass Balance Error (Percent)	Total Worst Case Flux Entering Excavation	Flux per foot <sup>2</sup> Entering Drains (feet <sup>3</sup> /day)	Condition	Remarks
	Horizontal	Vertical							
1997 Colog Analysis	Greg1	0.0014	0.0014	357	357	0.00	NA	NA	Calibration model from GLA (1997) using low K value from Colog well tests.
	Greg2	0.0014	0.0014	290	290	0.00	269 feet <sup>3</sup> /day (2,010 gal/day)	NA	Drained condition model from GLA (1997) using low K value from Colog well tests.
	Greg3	0.0014 / 0.02	0.0014 / 0.02	3,114	3,114	0.00	NA	NA	Calibration model from GLA (1997) using high K value from Colog well tests.
	Greg4	0.0014 / 0.02	0.0014 / 0.02	2,135	2,135	0.01	1,936 feet <sup>3</sup> /day (14,480 gal/day)	0.0007	Drained condition model from GLA (1997) using high K value from Colog well tests.
Current Pumping Test Analyses	G1	0.09 / 0.009	0.09 / 0.009	6,167	6,164	0.04	NA	NA	Current calibration model using K value from well pumping tests. K value decreases one order of magnitude below a depth of 200 feet. Short term condition.
	G2	0.09 / 0.009	0.09 / 0.009	5,908	5,913	0.08	5,200 feet <sup>3</sup> /day (38,900 gal/day)	0.0019	Current drained condition model using K value from well pumping tests. K value drops one order of magnitude below a depth of 200 feet. Short term condition.
	G3	0.09	0.09	14,768	14,841	0.49	NA	NA	Current calibration model using K value from mid-stage well pumping tests. K value remains same throughout the model domain. Short term condition.
	G4	0.09	0.09	12,848	12,920	0.55	11,380 feet <sup>3</sup> /day (85,130 gal/day)	0.0043	Current drained condition model using K value from mid-stage well pumping tests. K value remains the same throughout the model domain. Short term condition.
	G5	0.015	0.015	2,366	2,374	0.34	NA	NA	Current calibration model using K value from late-stage well pumping tests. K value remains same throughout the model domain. Long term condition.
	G6	0.015	0.015	1,946	1,954	0.4	1,763 feet <sup>3</sup> /day (13,190 gal/day)	0.0007	Current drained condition model using K value from late-stage well pumping tests. K value remains the same throughout the model domain. Long term condition.

## FIGURES





**EXPLANATION:**

- DRY SANDY ALLUVIUM
- WET SANDY ALLUVIUM
- BEDROCK
- DRY FRACTURE
- WET FRACTURE
- APPROXIMATE GEOLOGIC CONTACT
- WATER TABLE
- PIEZOMETRIC SURFACE
- GROUNDWATER FLOW DIRECTION

NOT TO SCALE

FIGURE 1

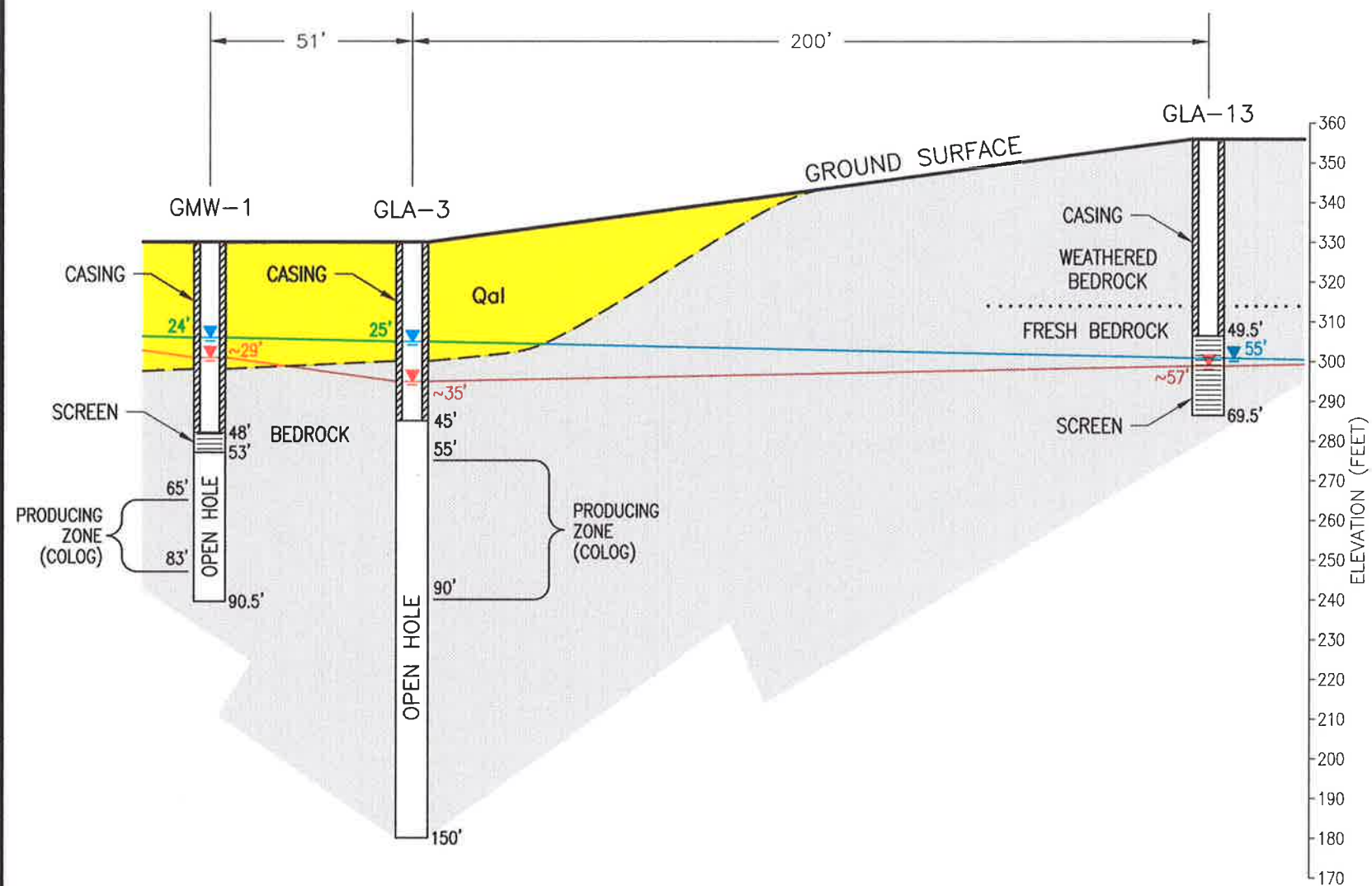
**FRACTURE FLOW SCHEMATIC**

**PHASE 5 SUPPLEMENTAL INVESTIGATION  
RESULTS OF PUMPING TESTS  
PROPOSED GREGORY CANYON LANDFILL  
SAN DIEGO COUNTY, CA**

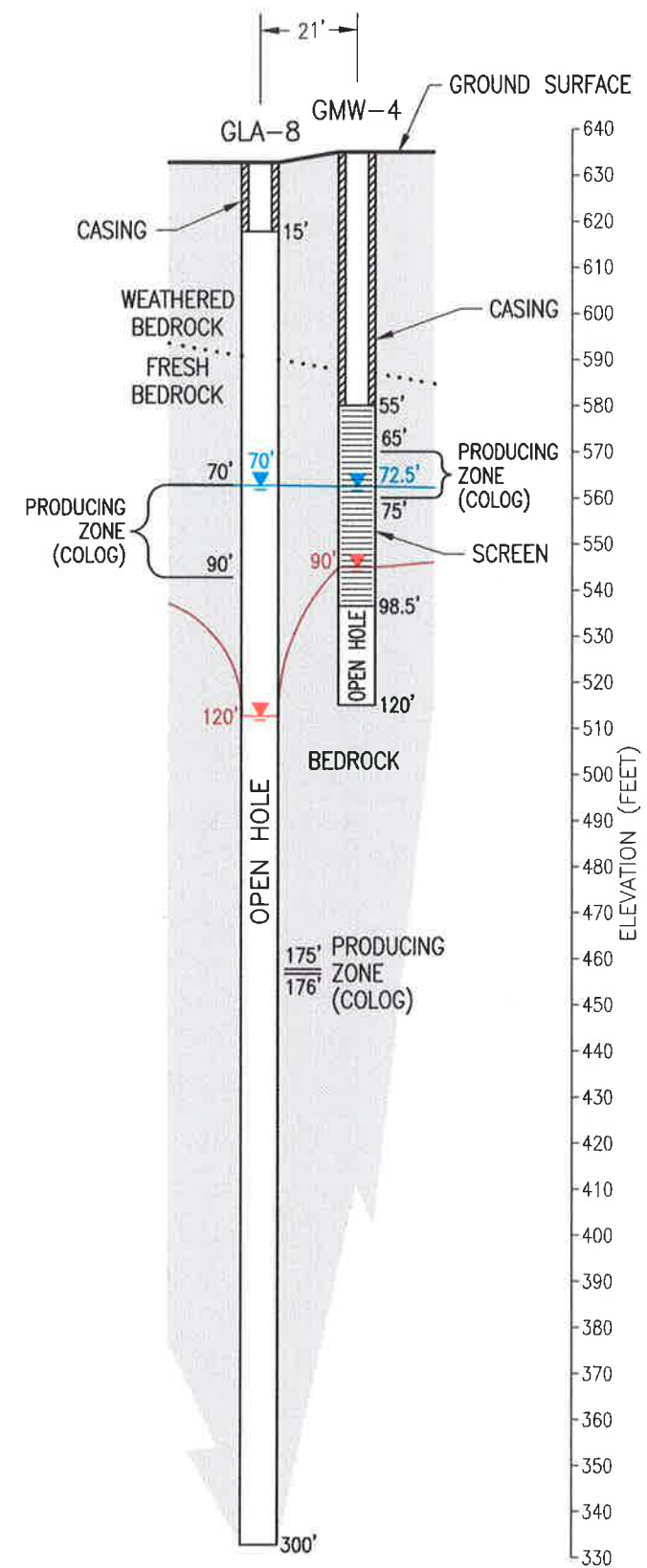


**GeoLogic Associates**  
Geologists, Hydrogeologists, and Engineers

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PUMPING TEST #1 - HYDROGEOLOGIC SECTION



PUMPING TEST #2 - HYDROGEOLOGIC SECTION

**EXPLANATION:**

- Qal ALLUVIUM
- BEDROCK
- APPROXIMATE GEOLOGIC CONTACT
- ▼ 55' ORIGINAL PIEZOMETRIC SURFACE
- ▼ 90' PIEZOMETRIC SURFACE AFTER PUMPING

NOTE: BOREHOLE DIAMETERS ARE NOT TO SCALE

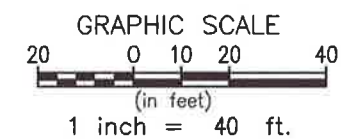


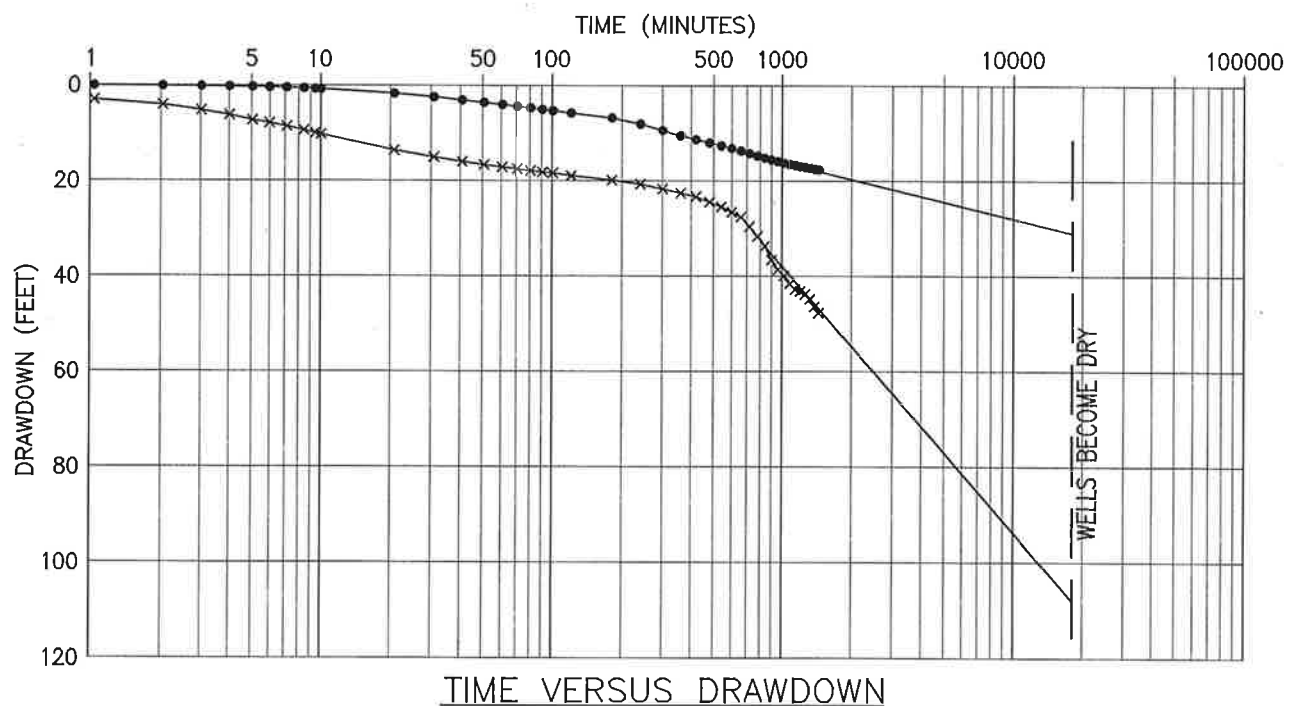
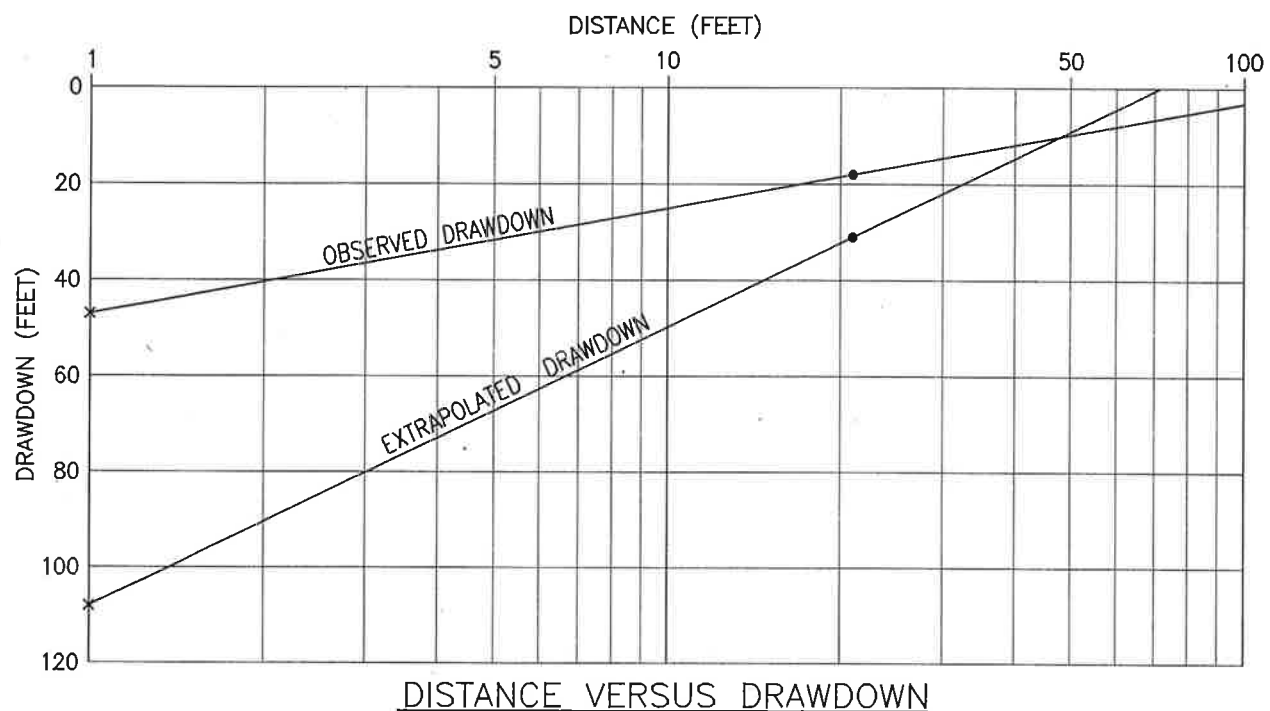
FIGURE 2

PUMP TESTS - HYDROGEOLOGIC SECTIONS  
PHASE 5 SUPPLEMENTAL INVESTIGATION  
RESULTS OF PUMPING TESTS  
PROPOSED GREGORY CANYON LANDFILL  
SAN DIEGO COUNTY, CA



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**EXPLANATION:**

- GMW-4
- x— GLA-8

FIGURE 3

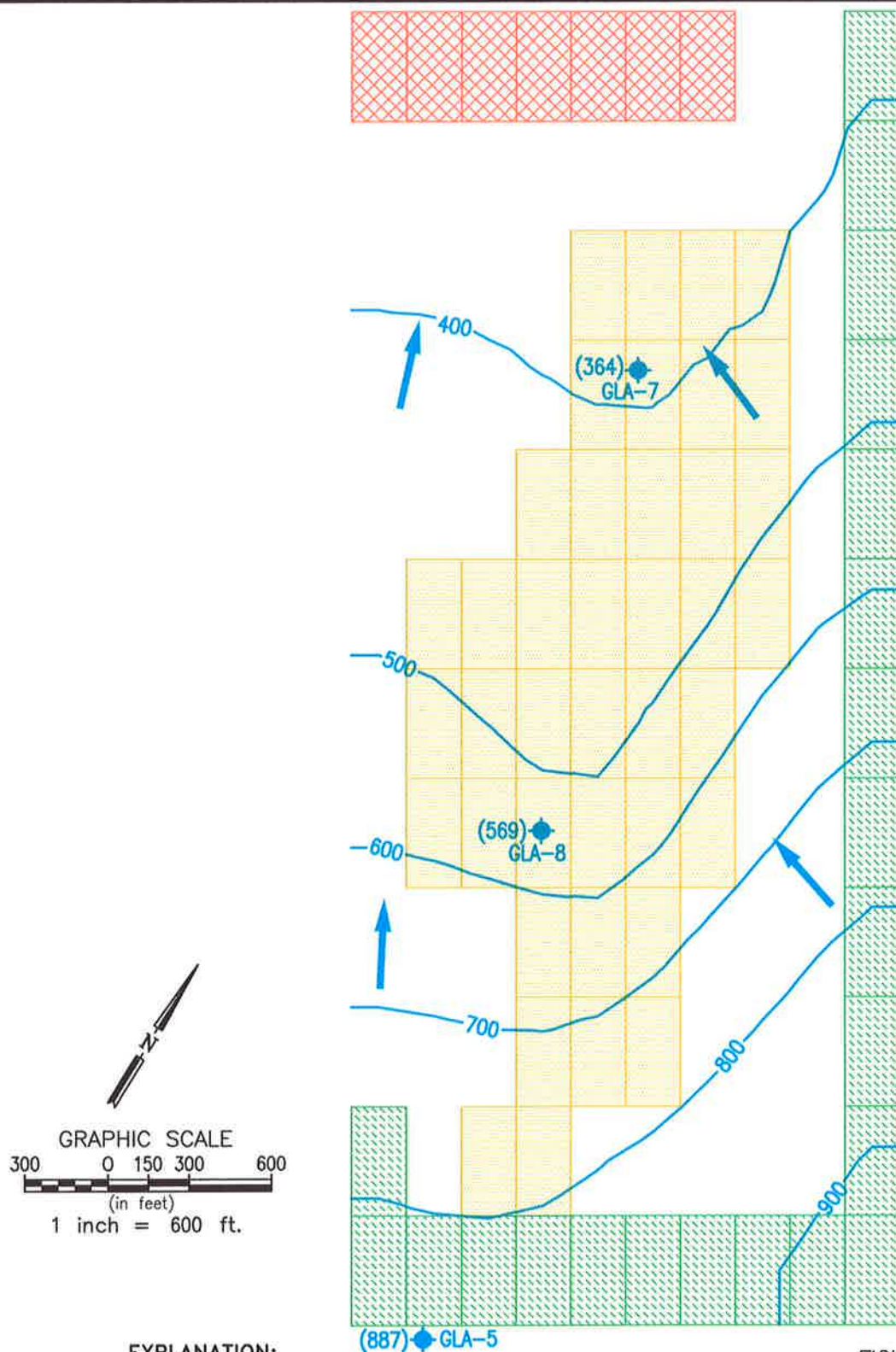
GLA-8 PUMPING TEST #2 RESULTS  
 PHASE 5 SUPPLEMENTAL INVESTIGATION  
 RESULTS OF PUMPING TESTS  
 PROPOSED GREGORY CANYON LANDFILL  
 SAN DIEGO COUNTY, CA



**GeoLogic Associates**  
 Geologists, Hydrogeologists, and Engineers

DRAWN BY: VL	DATE: JANUARY 2001	JOB NO. 9539
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**EXPLANATION:**



GROUNDWATER MONITORING WELL

(364)

GROUNDWATER ELEVATION (FEET ABOVE MEAN SEA LEVEL)

500

GROUNDWATER EQUIPOTENTIAL LINES - DRAINED  
CONDITION (FEET ABOVE MEAN SEA LEVEL)



GROUNDWATER FLOW DIRECTION



DRAIN CELLS



CONSTANT FLUX NODES



CONSTANT HEAD NODES

FIGURE 4

MODFLOW MODEL G2

PHASE 5 SUPPLEMENTAL INVESTIGATION  
RESULTS OF PUMPING TESTS  
PROPOSED GREGORY CANYON LANDFILL  
SAN DIEGO COUNTY, CA

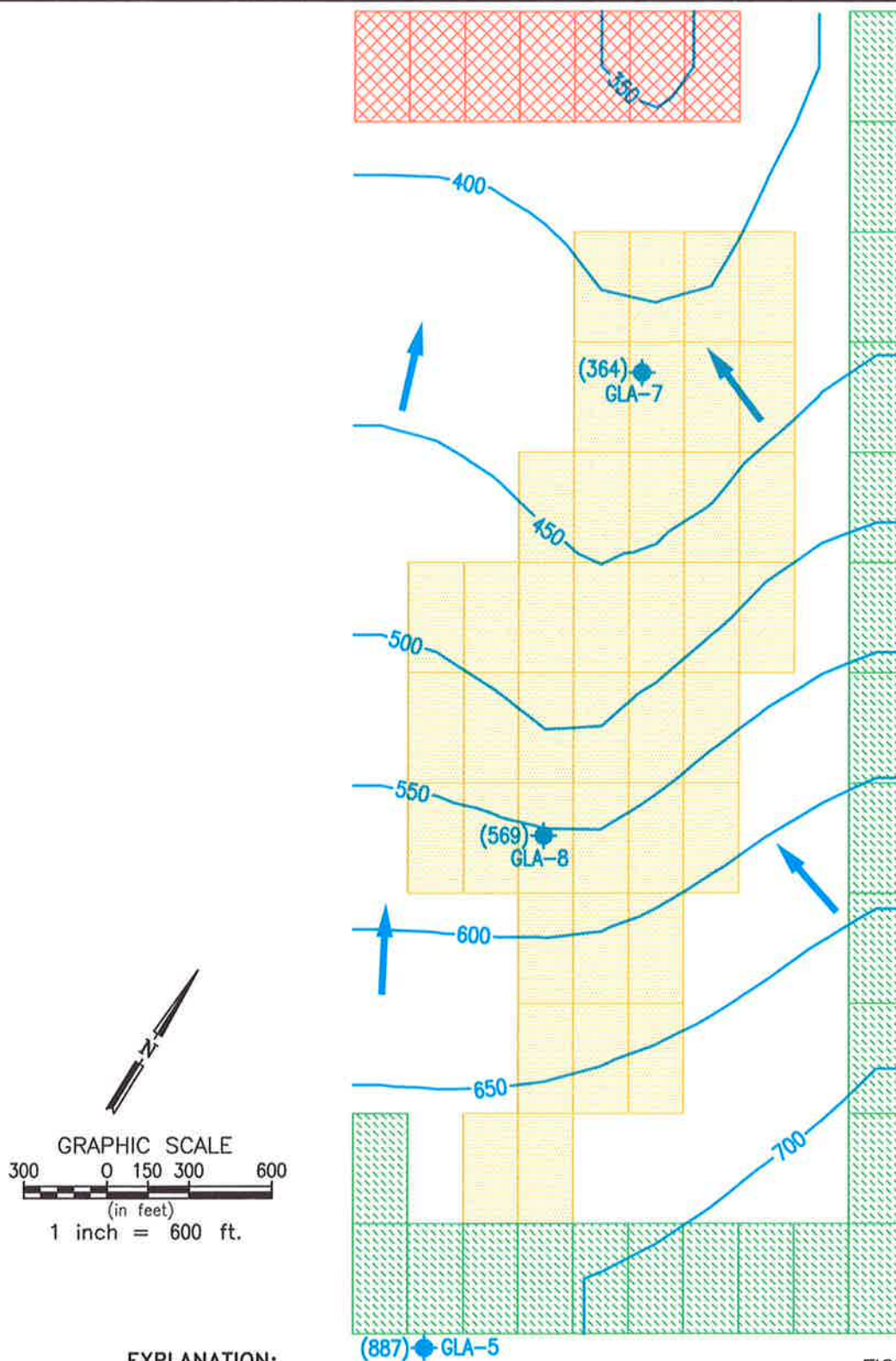


**GeoLogic Associates**  
Geologists, Hydrogeologists, and Engineers

DRAWN BY:  
VL

DATE:  
JANUARY 2001

JOB NO.  
9539



**EXPLANATION:**



GROUNDWATER MONITORING WELL

(364)

GROUNDWATER ELEVATION (FEET ABOVE MEAN SEA LEVEL)

500

GROUNDWATER EQUIPOTENTIAL LINES - DRAINED  
CONDITION (FEET ABOVE MEAN SEA LEVEL)



GROUNDWATER FLOW DIRECTION



DRAIN CELLS



CONSTANT FLUX NODES



CONSTANT HEAD NODES

FIGURE 5

MODFLOW MODEL G4

PHASE 5 SUPPLEMENTAL INVESTIGATION  
RESULTS OF PUMPING TESTS  
PROPOSED GREGORY CANYON LANDFILL  
SAN DIEGO COUNTY, CA



**GeoLogic Associates**

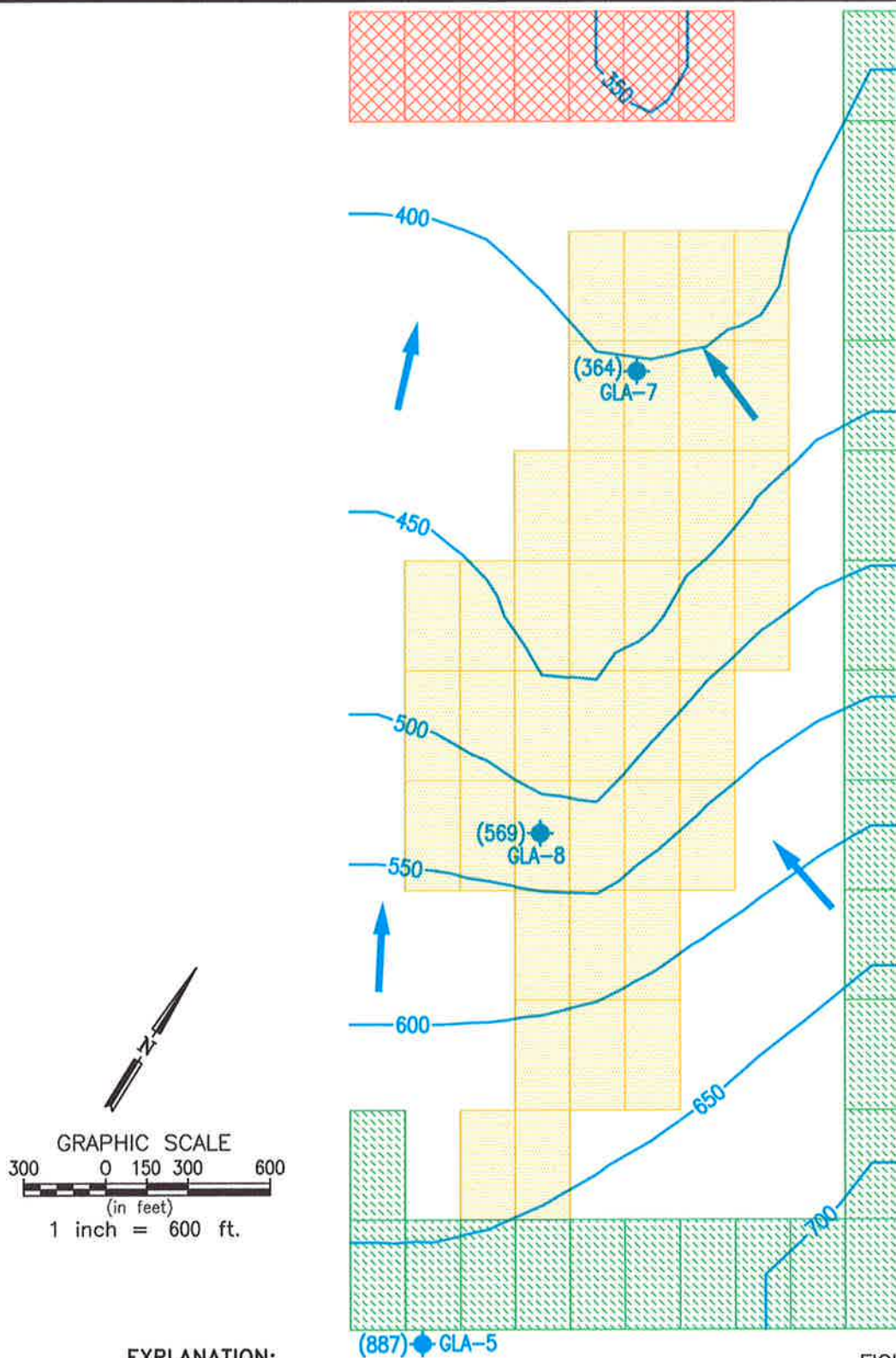
Geologists, Hydrogeologists, and Engineers

DRAWN BY:  
VL

DATE:  
JANUARY 2001

JOB NO.  
9539





**EXPLANATION:**

- GROUNDWATER MONITORING WELL
- (364)** GROUNDWATER ELEVATION (FEET ABOVE MEAN SEA LEVEL)
- GROUNDWATER EQUIPOTENTIAL LINES - DRAINED CONDITION (FEET ABOVE MEAN SEA LEVEL)
- GROUNDWATER FLOW DIRECTION
- DRAIN CELLS
- CONSTANT FLUX NODES
- CONSTANT HEAD NODES

FIGURE 6

MODFLOW MODEL G6

PHASE 5 SUPPLEMENTAL INVESTIGATION  
RESULTS OF PUMPING TESTS  
PROPOSED GREGORY CANYON LANDFILL  
SAN DIEGO COUNTY, CA



**GeoLogic Associates**  
Geologists, Hydrogeologists, and Engineers

DRAWN BY: VL	DATE: JANUARY 2001	JOB NO. 9539
-----------------	-----------------------	-----------------

## **APPENDIX A**

### **PUMP TEST #1 DATA**

**GeoLogic Associates**  
1360 Valley Vista Drive  
Diamond Bar, California  
(909) 860-3448

Pumping test analysis  
Time-Drawdown-method after  
COOPER & JACOB  
Unconfined aquifer

Date: 08.12.2000 Page 1

Project: Gregory Canyon Pump Test

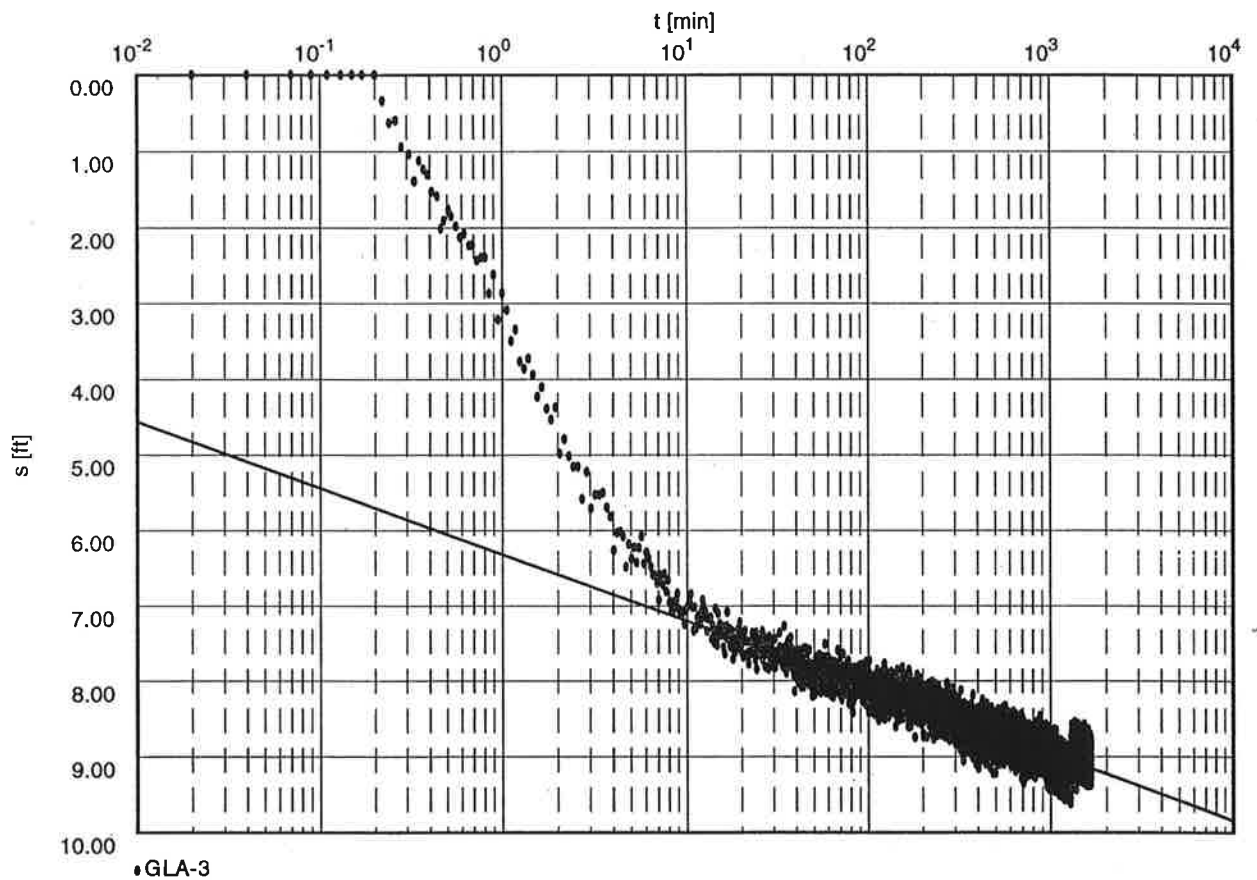
Evaluated by: wbl

Pumping Test No. 1

Test conducted on: 28.11.2000

GLA-3 (pumping well)

Discharge 10.00 U.S.gal/min



Transmissivity [ft<sup>2</sup>/min]:  $2.77 \times 10^{-1}$

Hydraulic conductivity [ft/min]:  $4.62 \times 10^{-3}$

Aquifer thickness [ft]: 60.00

**GeoLogic Associates**  
1360 Valley Vista Drive  
Diamond Bar, California  
(909) 860-3448

Pumping test analysis  
Time-Drawdown-method after  
COOPER & JACOB  
Confined aquifer

Date: 08.12.2000 Page 1

Project: Gregory Canyon Pump Test

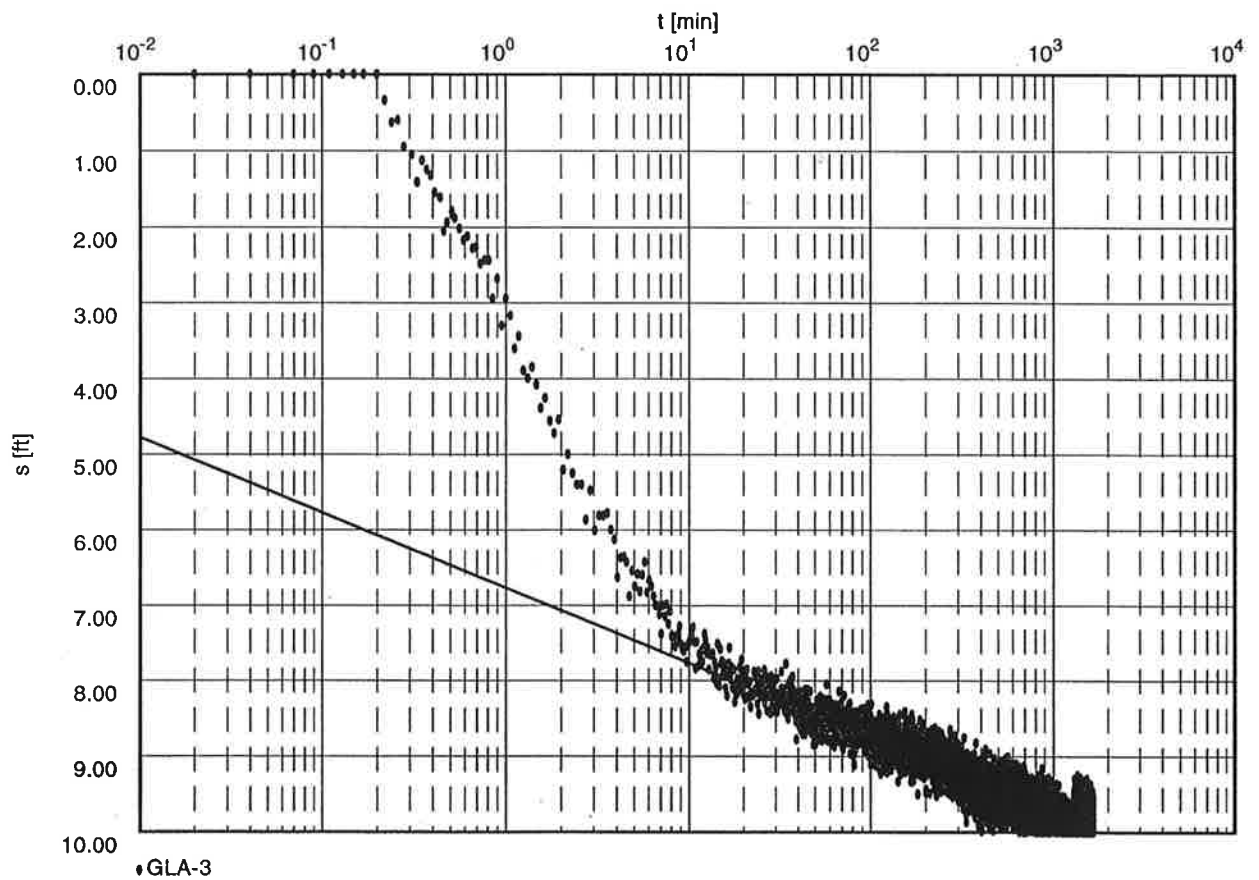
Evaluated by: wbl

Pumping Test No. 1

Test conducted on: 28.11.2000

GLA-3 (pumping well)

Discharge 10.00 U.S.gal/min



Transmissivity [ft<sup>2</sup>/min]:  $2.45 \times 10^{-1}$

Hydraulic conductivity [ft/min]:  $4.09 \times 10^{-3}$

Aquifer thickness [ft]: 60.00

Storativity:  $8.87 \times 10^{-8}$

**GeoLogic Associates**  
1360 Valley Vista Drive  
Diamond Bar, California  
(909) 860-3448

Pumping test analysis  
Theis analysis method  
Unconfined aquifer

Date: 08.12.2000 Page 1

Project: Gregory Canyon Pump Test

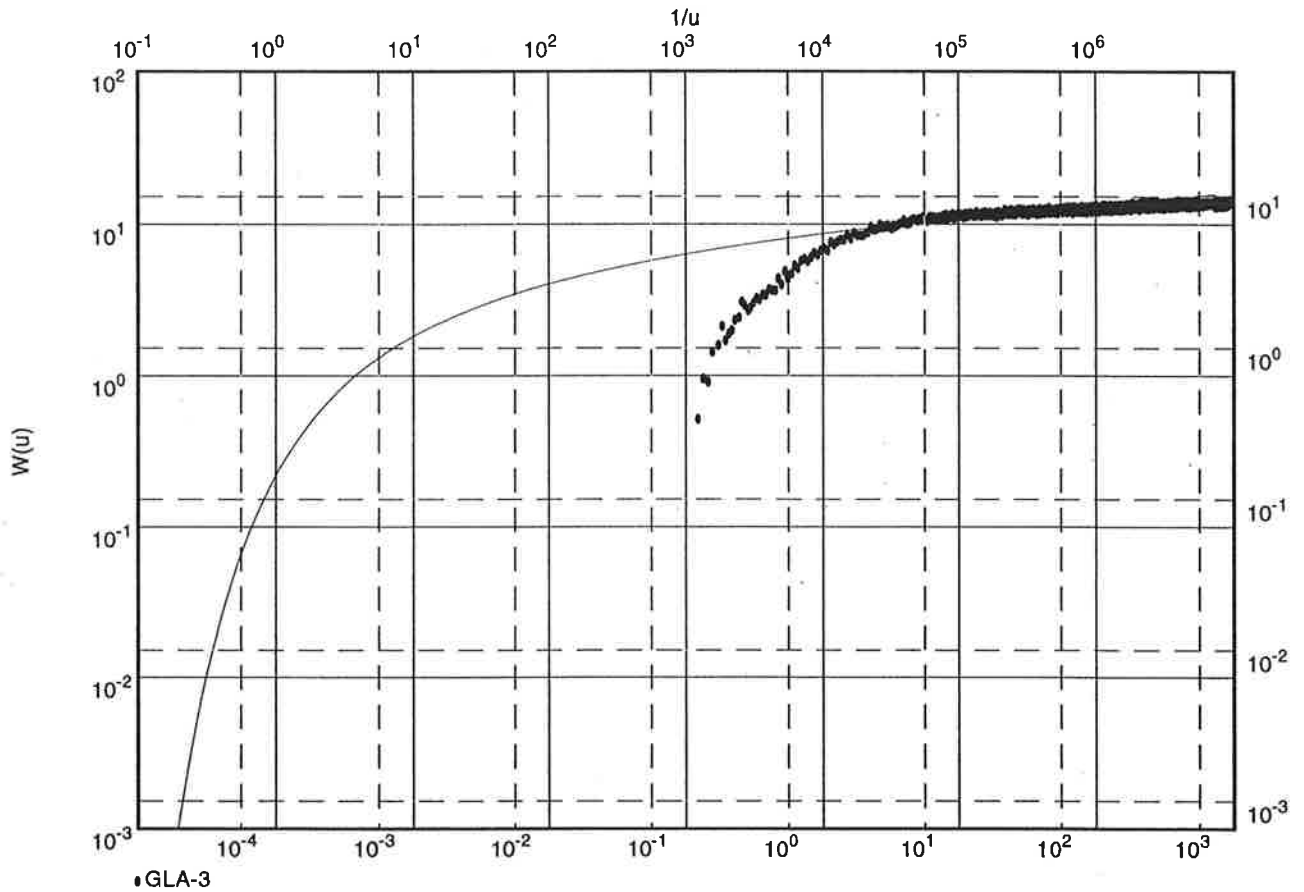
Evaluated by: wbl

Pumping Test No. 1

Test conducted on: 28.11.2000

GLA-3 (pumping well)

Discharge 10.00 U.S.gal/min



Transmissivity [ $\text{ft}^2/\text{min}$ ]:  $1.61 \times 10^{-1}$

Hydraulic conductivity [ $\text{ft}/\text{min}$ ]:  $2.69 \times 10^{-3}$

Aquifer thickness [ $\text{ft}$ ]: 60.00



**GeoLogic Associates**  
1360 Valley Vista Drive  
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(909) 860-3448

Pumping test analysis  
Time-Drawdown-method after  
COOPER & JACOB  
Unconfined aquifer

Date: 08.12.2000 Page 1

Project: Gregory Canyon Landfill

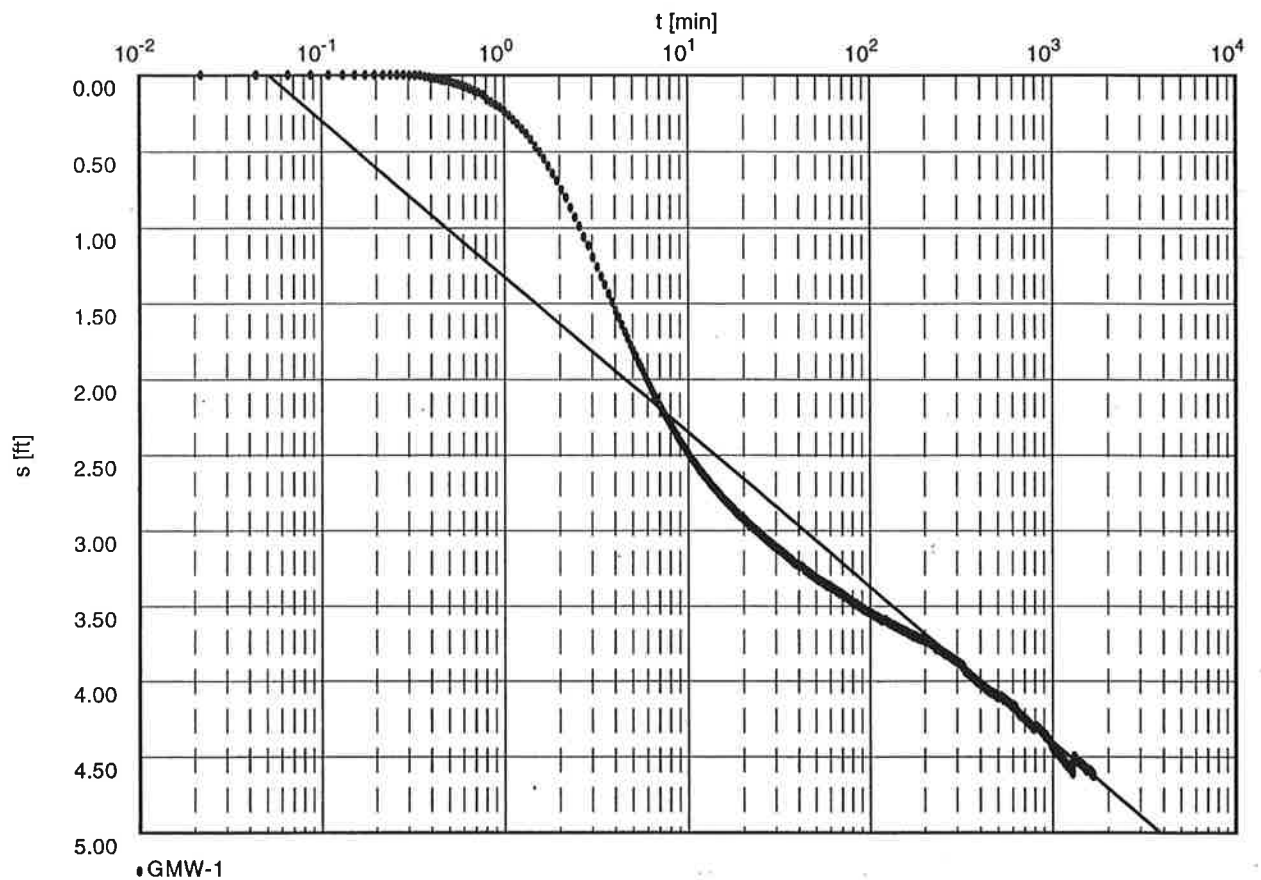
Evaluated by: wbl

Pumping Test No. 1

Test conducted on: 28.11.2000

GMW-1 (observation)

Discharge 10.00 U.S.gal/min



Transmissivity [ $\text{ft}^2/\text{min}$ ]:  $2.38 \times 10^{-1}$

Hydraulic conductivity [ $\text{ft}/\text{min}$ ]:  $4.59 \times 10^{-3}$

Aquifer thickness [ft]: 52.00

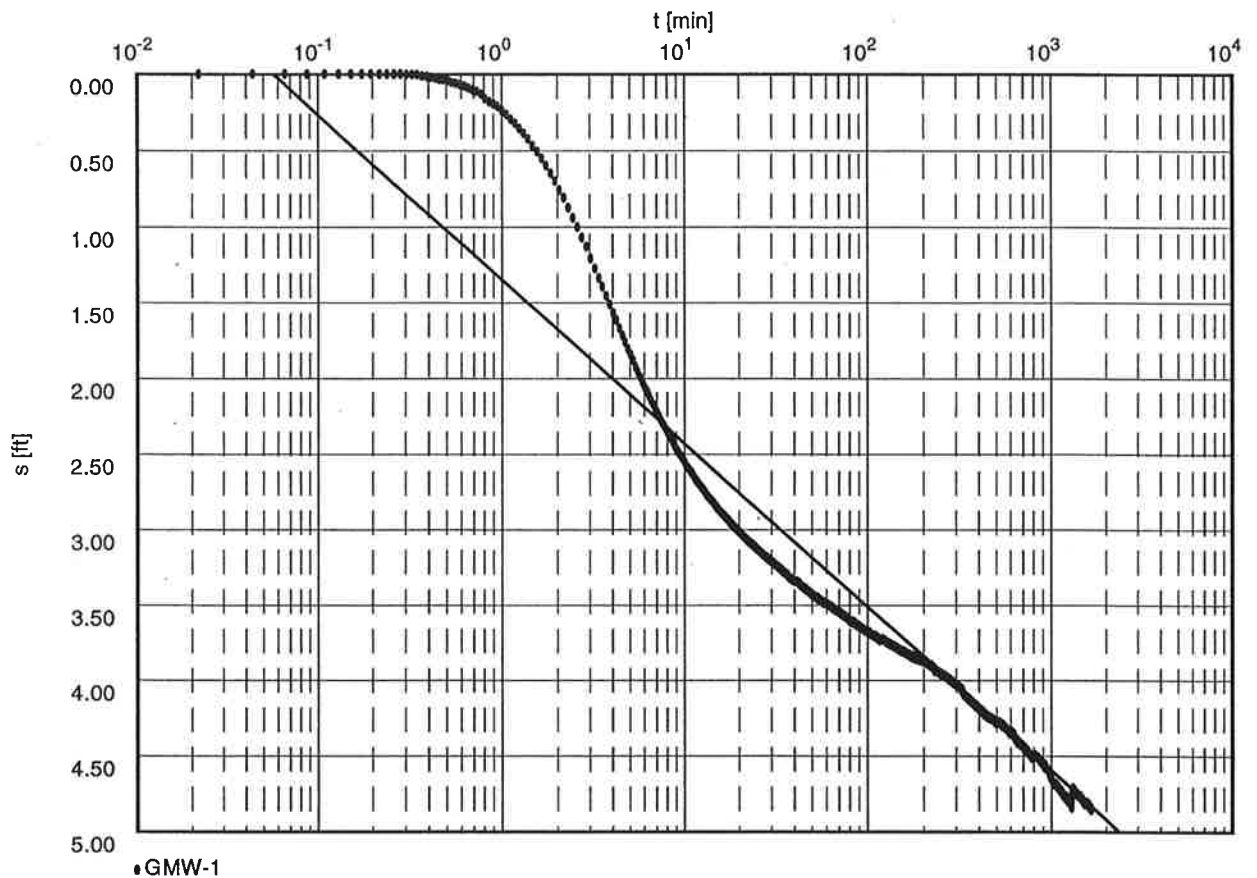


Pumping Test No. 1

Test conducted on: 28.11.2000

GMW-1 (observation)

Discharge 10.00 U.S.gal/min



Transmissivity [ $\text{ft}^2/\text{min}$ ]:  $2.26 \times 10^{-1}$

Hydraulic conductivity [ $\text{ft}/\text{min}$ ]:  $4.35 \times 10^{-3}$

Aquifer thickness [ft]: 52.00

Storativity:  $1.28 \times 10^{-4}$

**GeoLogic Associates**  
 1360 Valley Vista Drive  
 Diamond Bar, California  
 (909) 860-3448

Pumping test analysis  
 Theis analysis method  
 Unconfined aquifer

Date: 08.12.2000 Page 1

Project: Gregory Canyon Landfill

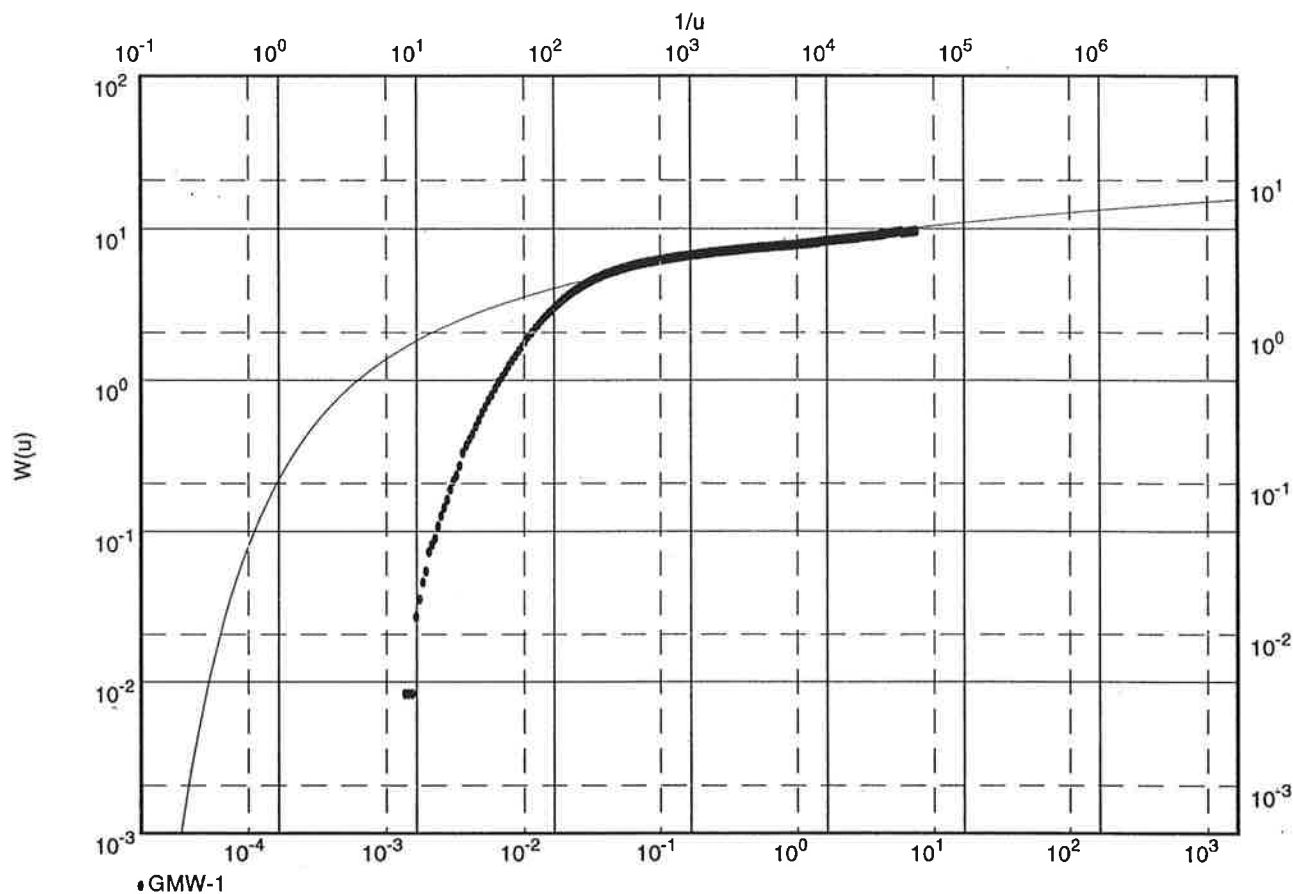
Evaluated by: wbl

Pumping Test No. 1

Test conducted on: 28.11.2000

GMW-1 (observation)

Discharge 10.00 U.S.gal/min



Transmissivity [ $\text{ft}^2/\text{min}$ ]:  $2.20 \times 10^{-1}$

Hydraulic conductivity [ $\text{ft}/\text{min}$ ]:  $4.23 \times 10^{-3}$

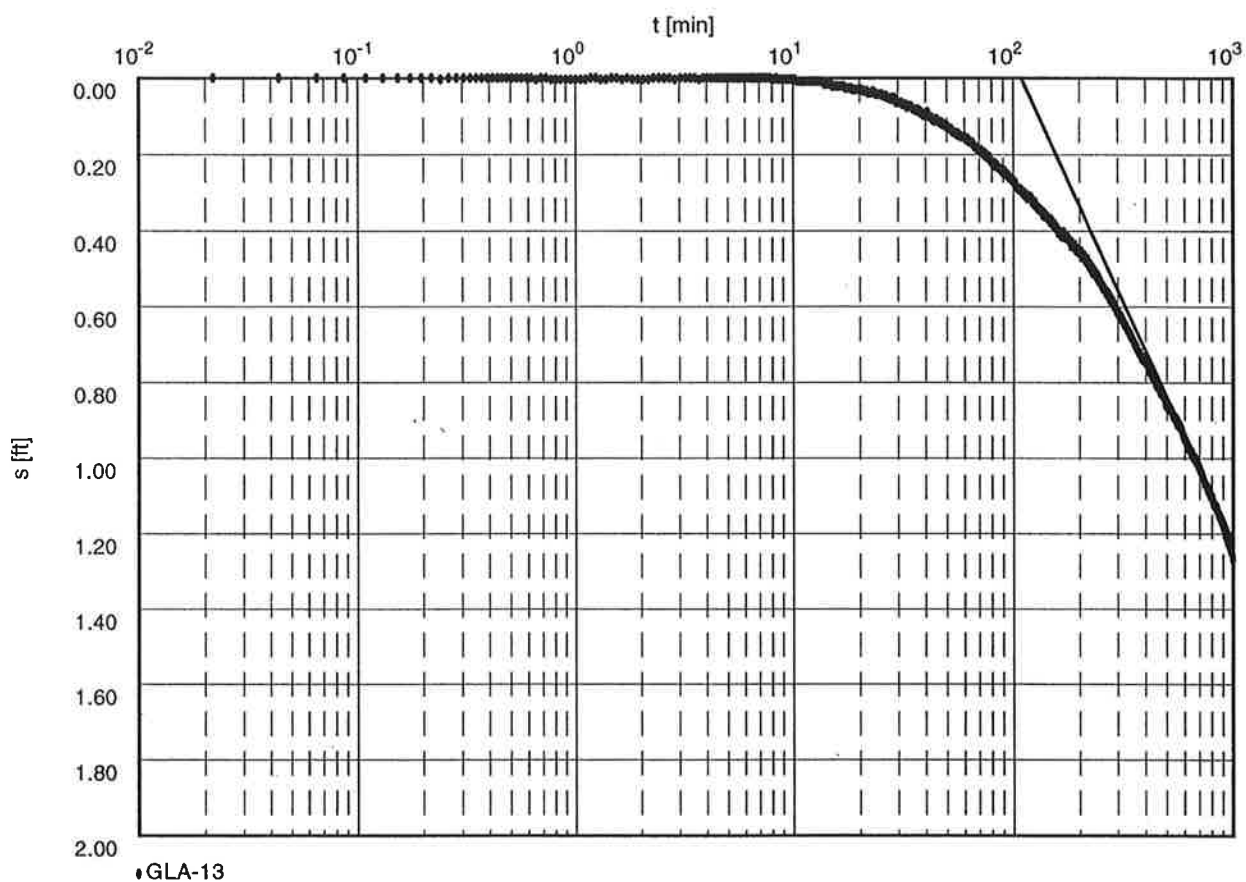
Aquifer thickness [ $\text{ft}$ ]: 52.00

Pumping Test No. 1

Test conducted on: 28.11.2000

GLA-13 (observation)

Discharge 10.00 U.S.gal/min



Transmissivity [ $\text{ft}^2/\text{min}$ ]:  $1.92 \times 10^{-1}$

Hydraulic conductivity [ $\text{ft}/\text{min}$ ]:  $1.33 \times 10^{-2}$

Aquifer thickness [ft]: 14.50

**GeoLogic Associates**  
 1360 Valley Vista Drive  
 Diamond Bar, California  
 (909) 860-3448

Pumping test analysis  
 Time-Drawdown-method after  
**COOPER & JACOB**  
 Confined aquifer

Date: 08.12.2000 Page 1

Project: Gregory Canyon Pump Test

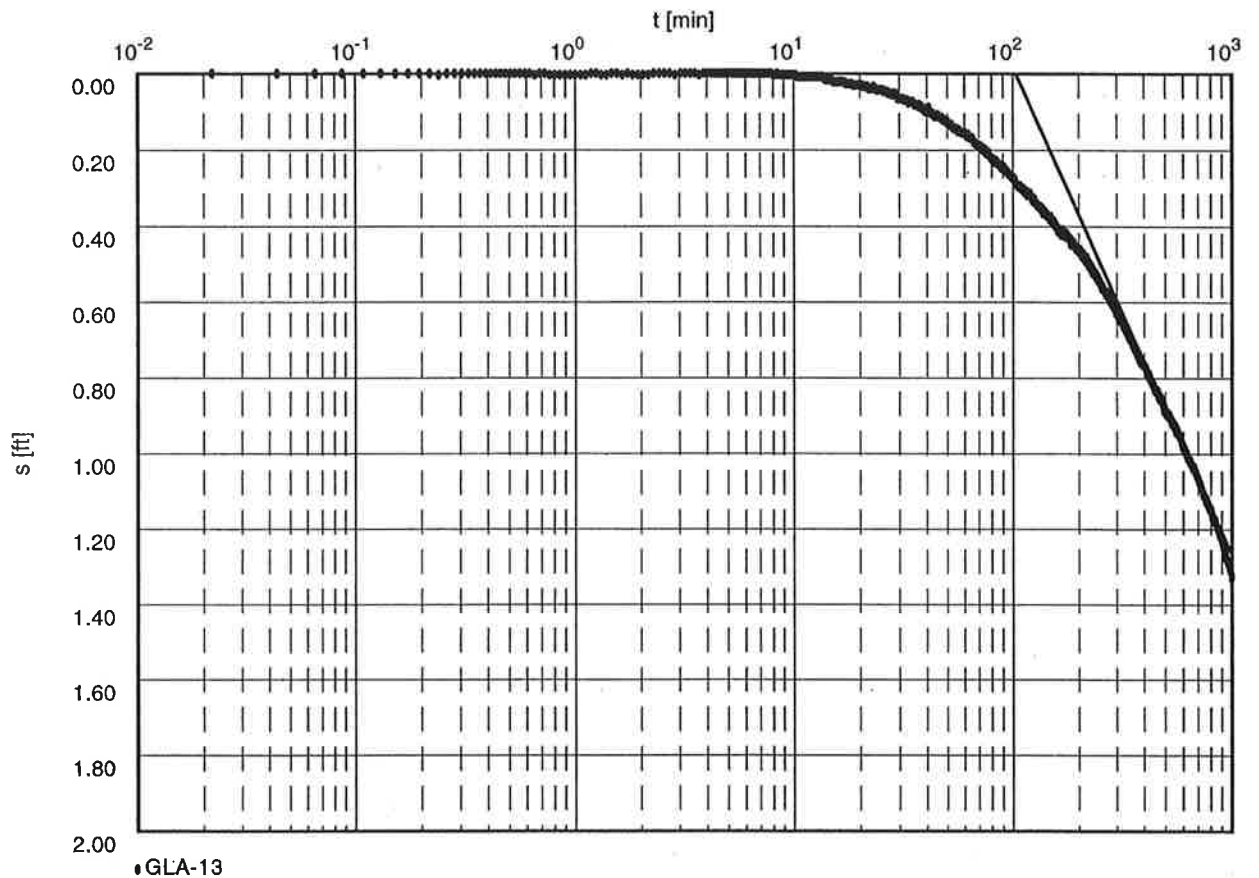
Evaluated by: wbl

Pumping Test No. 1

Test conducted on: 28.11.2000

GLA-13 (observation)

Discharge 10.00 U.S.gal/min



Transmissivity [ $\text{ft}^2/\text{min}$ ]:  $1.90 \times 10^{-1}$

Storativity:  $1.10 \times 10^{-3}$

**GeoLogic Associates**  
1360 Valley Vista Drive  
Diamond Bar, California  
(909) 860-3448

Pumping test analysis  
Theis analysis method  
Unconfined aquifer

Date: 08.12.2000 Page 1

Project: Gregory Canyon Pump Test

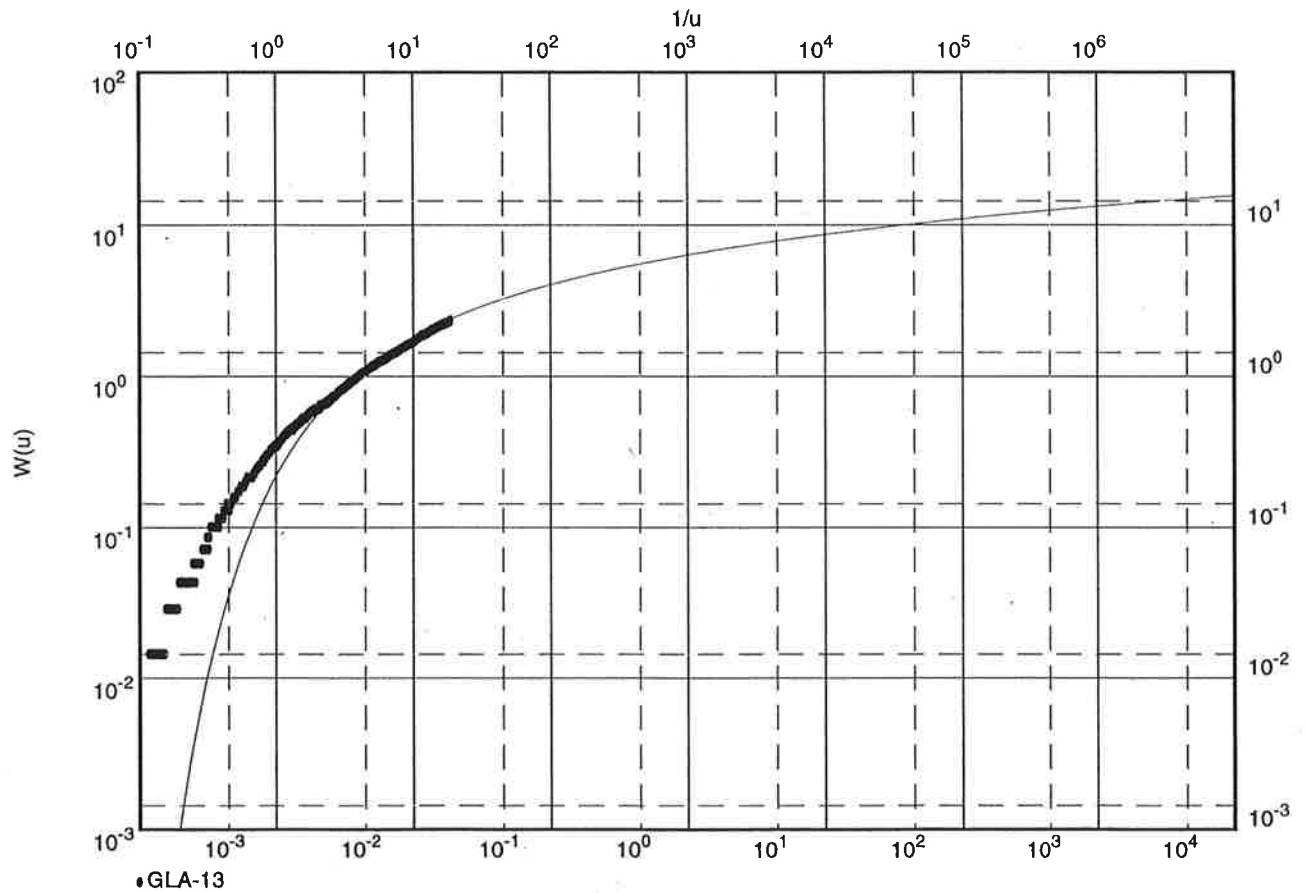
Evaluated by: wbl

Pumping Test No. 1

Test conducted on: 28.11.2000

GLA-13 (observation)

Discharge 10.00 U.S.gal/min



Transmissivity [ $\text{ft}^2/\text{min}$ ]:  $1.52 \times 10^{-1}$

Hydraulic conductivity [ $\text{ft}/\text{min}$ ]:  $1.05 \times 10^{-2}$

Aquifer thickness [ $\text{ft}$ ]: 14.50

**GeoLogic Associates**  
1360 Valley Vista Drive  
Diamond Bar, California  
(909) 860-3448

Pumping test analysis  
Distance-Drawdown-method after  
**COOPER & JACOB**  
Unconfined aquifer

Date: 08.12.2000 Page 1

Project: Gregory Canyon Pump Test

Evaluated by: wbl

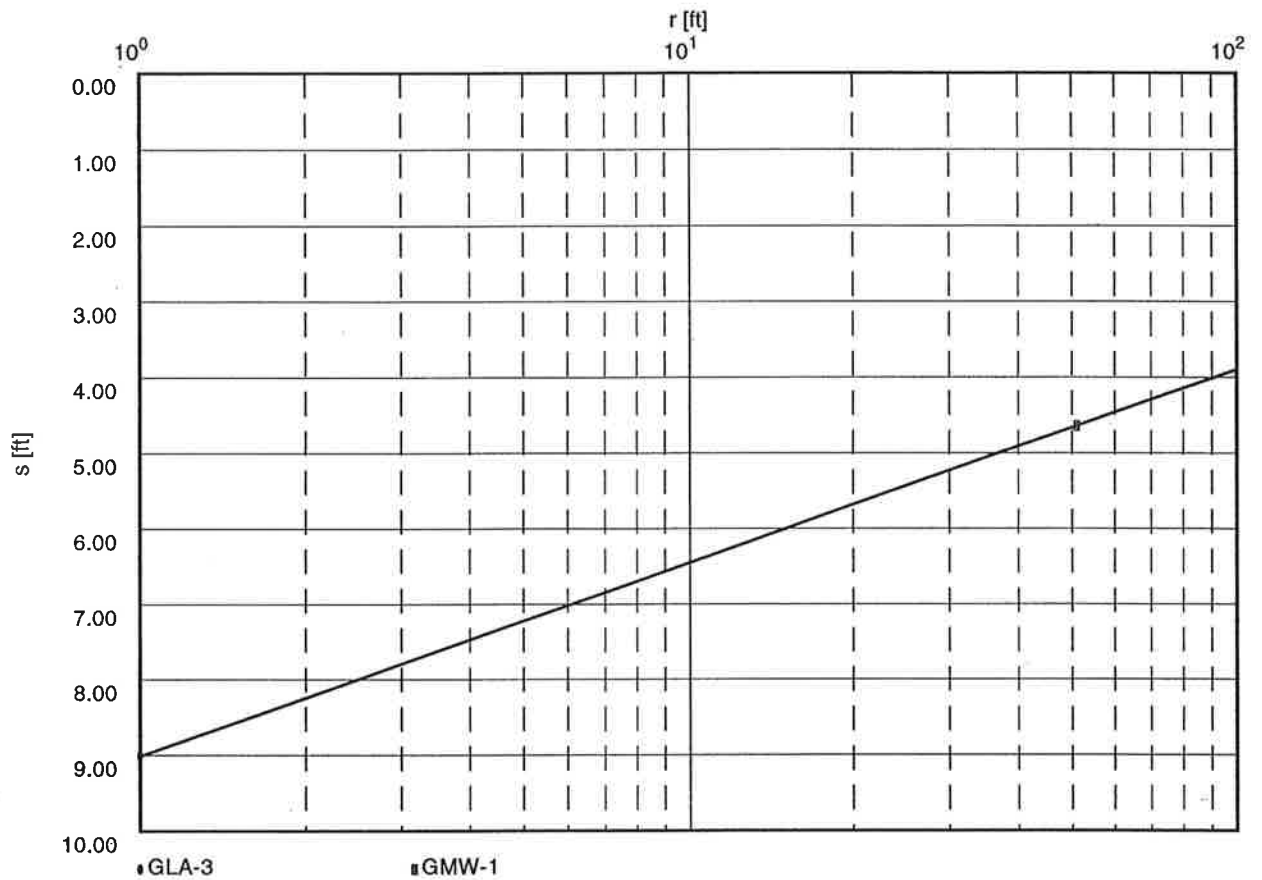
Pumping Test No. 1

Test conducted on: 28.11.2000

GLA-3 (pumping well)

Discharge 10.00 U.S.gal/min

Analysis at time (t) 1600.00 min



Transmissivity [ft<sup>2</sup>/min]:  $1.91 \times 10^{-1}$

Hydraulic conductivity [ft/min]:  $3.18 \times 10^{-3}$

Aquifer thickness [ft]: 60.00

**GeoLogic Associates**  
1360 Valley Vista Drive  
Diamond Bar, California  
(909) 860-3448

Pumping test analysis  
Distance-Drawdown-method after  
COOPER & JACOB  
Unconfined aquifer

Date: 08.12.2000 Page 1

Project: Gregory Canyon Pump Test

Evaluated by: wbl

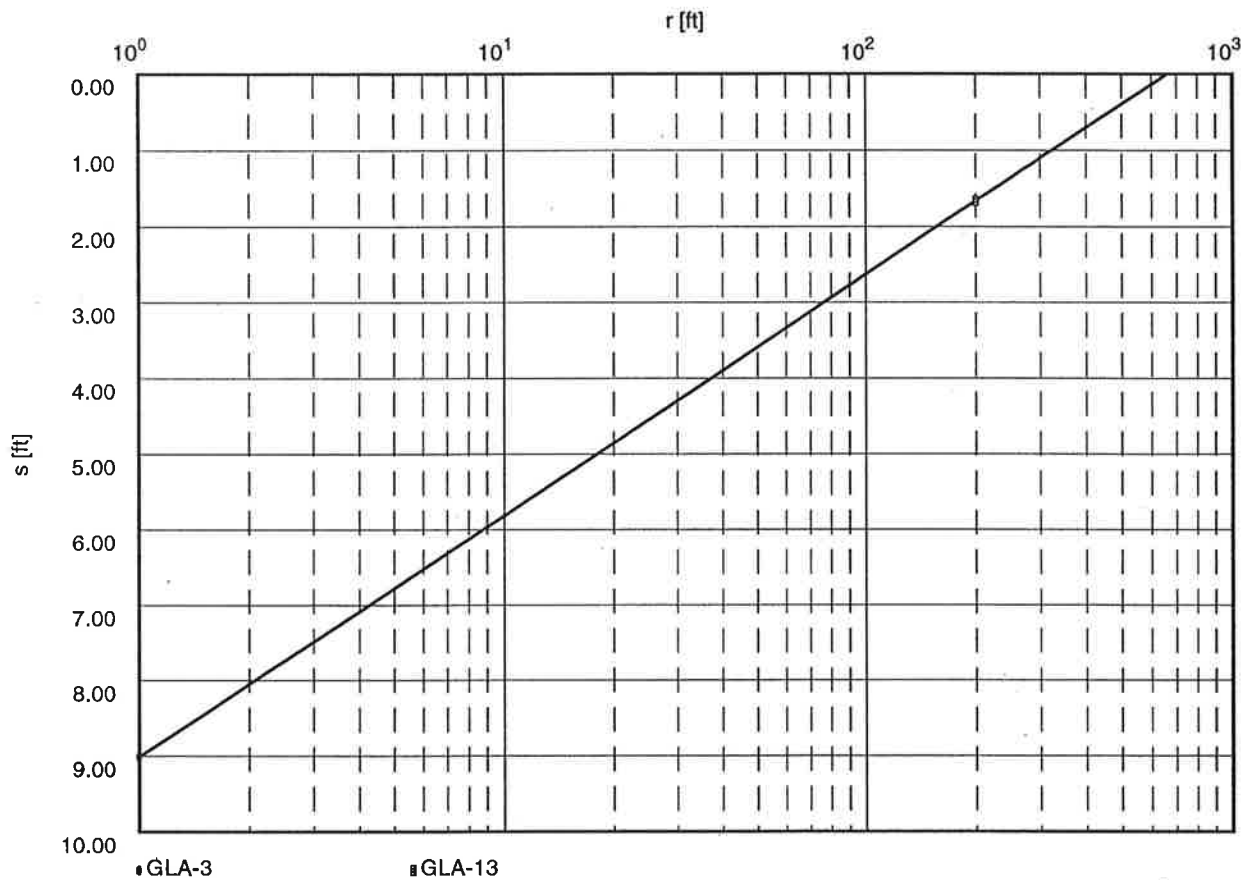
Pumping Test No. 1

Test conducted on: 28.11.2000

GLA-3 (pumping well)

Discharge 10.00 U.S.gal/min

Analysis at time (t) 1600.00 min



Transmissivity [ft<sup>2</sup>/min]:  $1.53 \times 10^{-1}$

Hydraulic conductivity [ft/min]:  $2.55 \times 10^{-3}$

Aquifer thickness [ft]: 60.00

**GeoLogic Associates**  
 1360 Valley Vista Drive  
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 (909) 860-3448

Pumping test analysis  
 Distance-Drawdown-method after  
**COOPER & JACOB**  
 Unconfined aquifer

Date: 08.12.2000 Page 1

Project: Gregory Canyon Pump Test

Evaluated by: wbl

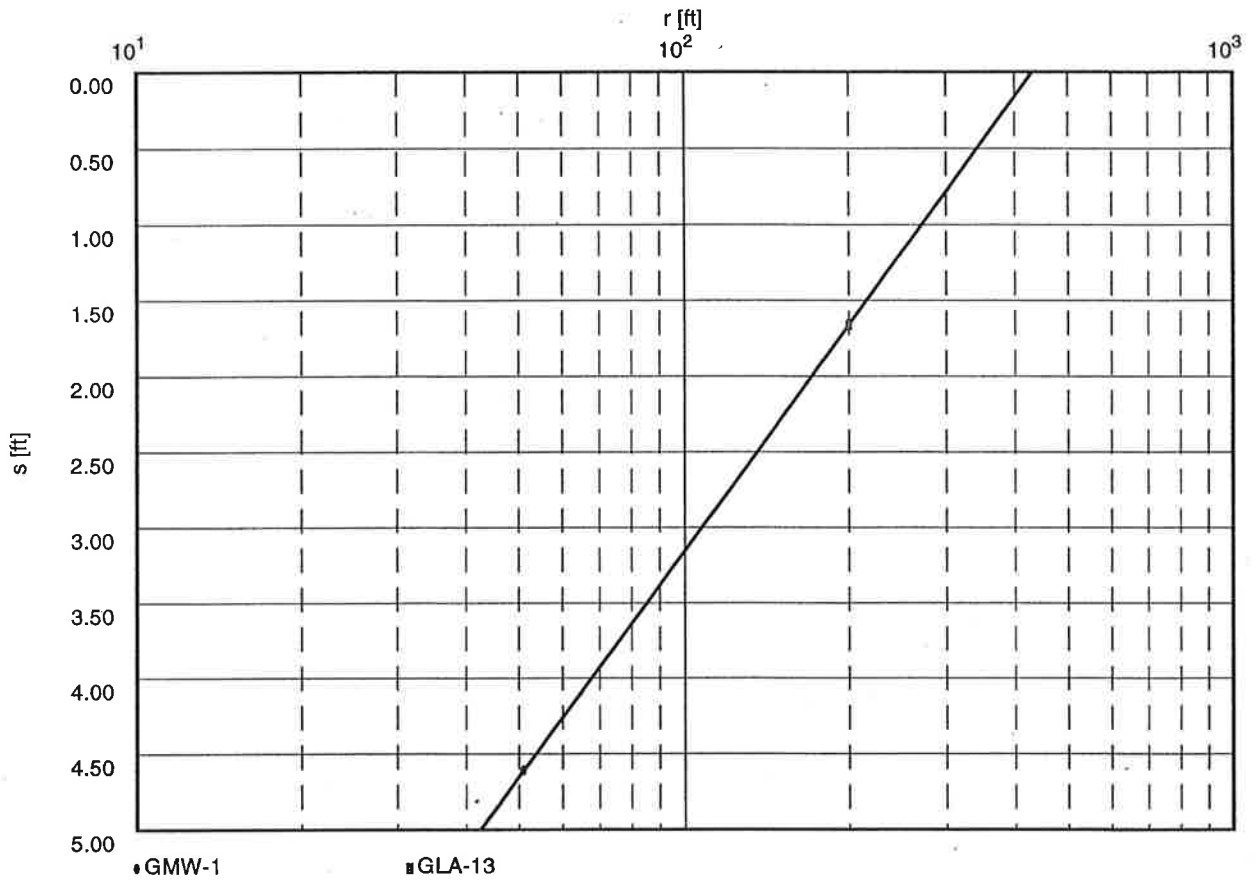
Pumping Test No. 1

Test conducted on: 28.11.2000

GLA-3 (pumping well)

Discharge 10.00 U.S.gal/min

Analysis at time (t) 1600.00 min



Transmissivity [ft<sup>2</sup>/min]:  $9.84 \times 10^{-2}$

Hydraulic conductivity [ft/min]:  $1.89 \times 10^{-3}$

Aquifer thickness [ft]: 52.00



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 1360 Valley Vista Drive  
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Pumping test analysis  
 Distance-Drawdown-method after  
**COOPER & JACOB**  
 Unconfined aquifer

Date: 08.12.2000 Page 1

Project: Gregory Canyon Pump Test

Evaluated by: wbl

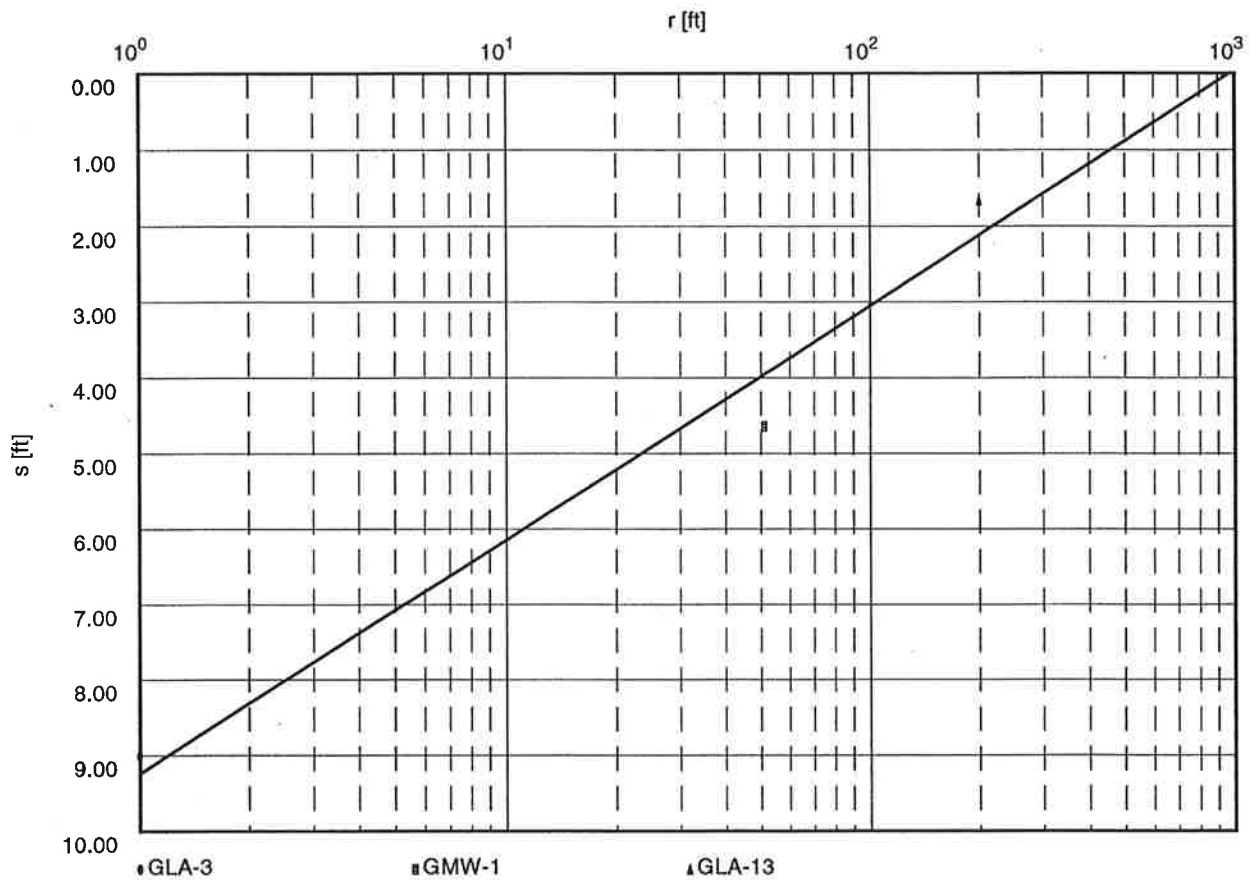
Pumping Test No. 1

Test conducted on: 28.11.2000

GLA-3 (pumping well)

Discharge 10.00 U.S.gal/min

Analysis at time (t) 1600.00 min



Transmissivity [ft<sup>2</sup>/min]:  $1.58 \times 10^{-1}$

Hydraulic conductivity [ft/min]:  $2.63 \times 10^{-3}$

Aquifer thickness [ft]: 60.00

**APPENDIX B**  
**PUMP TEST #2 DATA**

**GeoLogic Associates**  
1360 Valley Vista Drive  
Diamond Bar, California  
(909) 860-3448

Pumping test analysis  
Time-Drawdown-method after  
**COOPER & JACOB**  
Unconfined aquifer

Date: 08.12.2000 Page 1

Project: Gregory Canyon Landfill

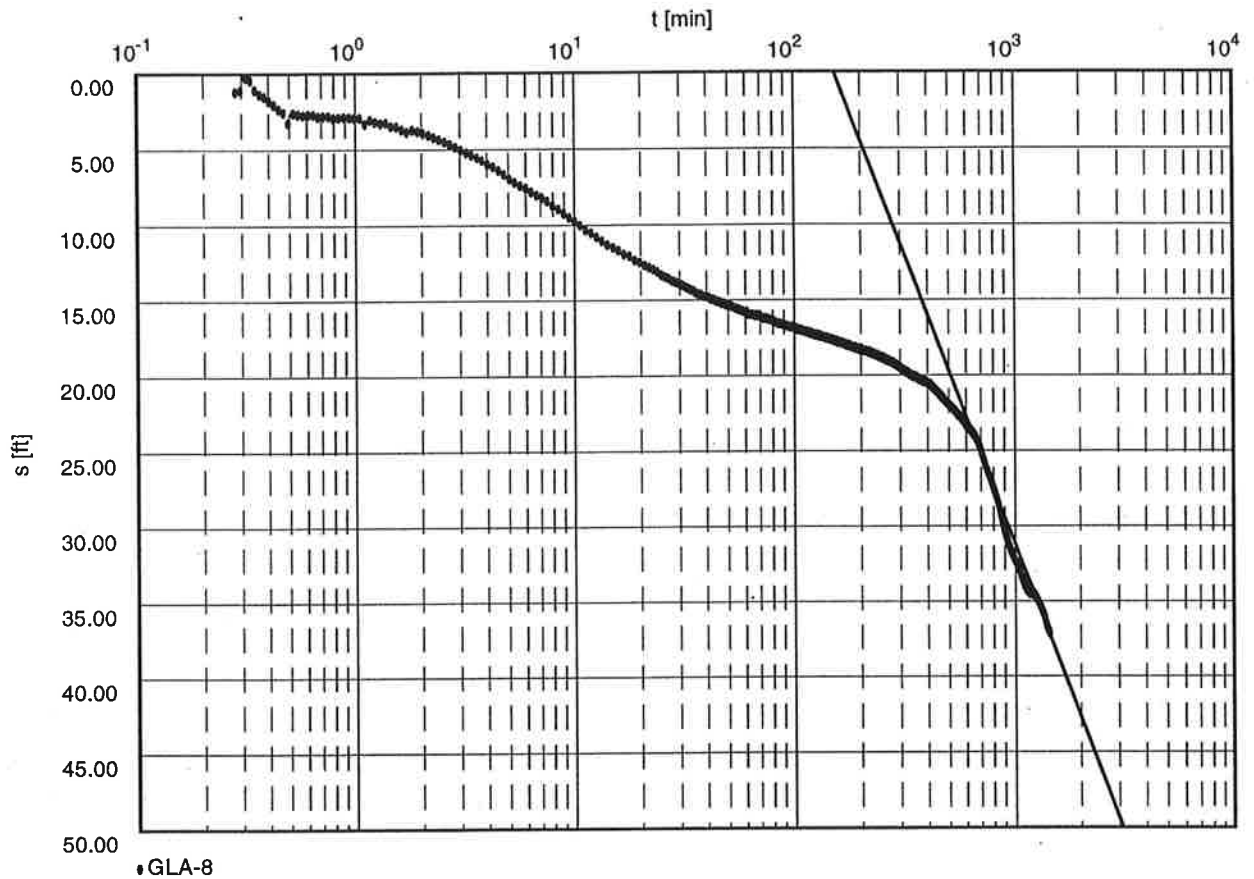
Evaluated by: wbl

Pumping Test No. 2.

Test conducted on: 29.11.2000

GLA-8 (pumping well)

Discharge 2.00 U.S.gal/min



Transmissivity [ft<sup>2</sup>/min]:  $1.28 \times 10^{-3}$

Hydraulic conductivity [ft/min]:  $1.18 \times 10^{-5}$

Aquifer thickness [ft]: 108.00

**GeoLogic Associates**

1360 Valley Vista Drive

Diamond Bar, California

(909) 860-3448

**Pumping test analysis**

Time-Drawdown-method after

**COOPER & JACOB**

Confined aquifer

Date: 08.12.2000

Page 1

Project: Gregory Canyon Landfill

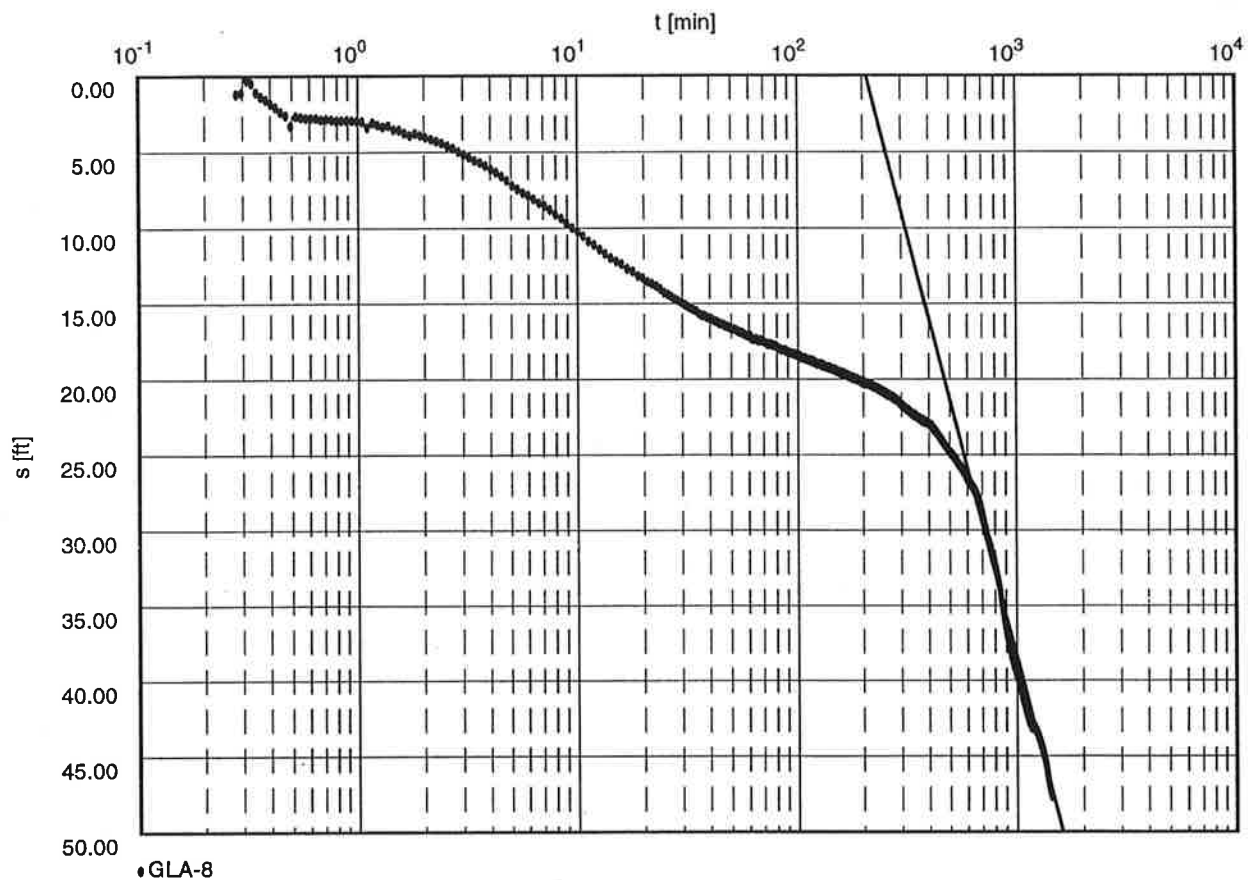
Evaluated by: wbl

Pumping Test No. 2

Test conducted on: 29.11.2000

GLA-8 (pumping well)

Discharge 2.00 U.S.gal/min

Transmissivity [ft<sup>2</sup>/min]:  $8.68 \times 10^{-4}$ Storativity:  $4.08 \times 10^{-1}$

**GeoLogic Associates**  
1360 Valley Vista Drive  
Diamond Bar, California  
(909) 860-3448

Pumping test analysis  
Time-Drawdown-method after  
COOPER & JACOB  
Unconfined aquifer

Date: 08.12.2000 Page 1

Project: Gregory Canyon Landfill

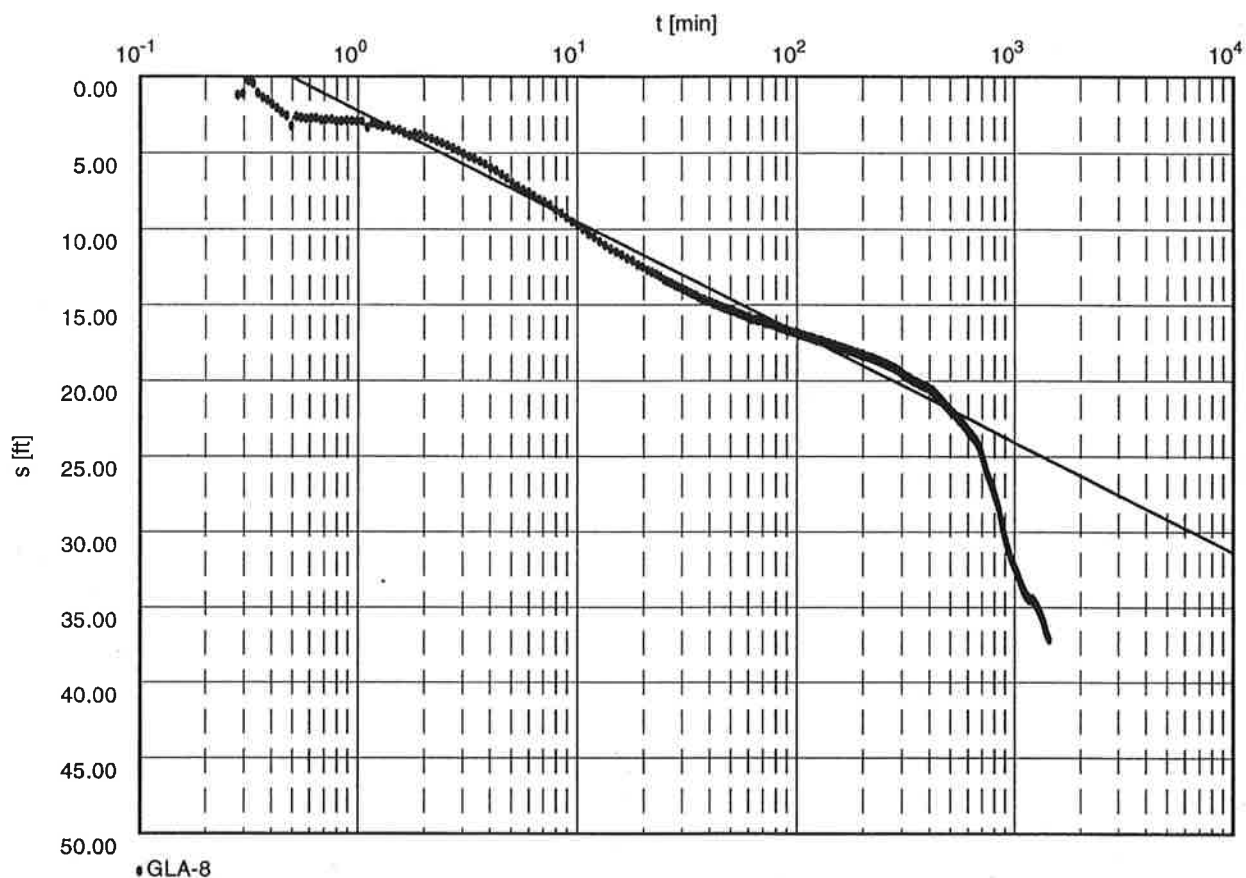
Evaluated by: wbl

Pumping Test No. 2

Test conducted on: 29.11.2000

GLA-8 (pumping well)

Discharge 2.00 U.S.gal/min



Transmissivity [ft<sup>2</sup>/min]:  $6.72 \times 10^{-3}$

Hydraulic conductivity [ft/min]:  $6.22 \times 10^{-5}$

Aquifer thickness [ft]: 108.00

**GeoLogic Associates**  
1360 Valley Vista Drive  
Diamond Bar, California  
(909) 860-3448

Pumping test analysis  
Time-Drawdown-method after  
COOPER & JACOB  
Confined aquifer

Date: 08.12.2000 Page 1

Project: Gregory Canyon Landfill

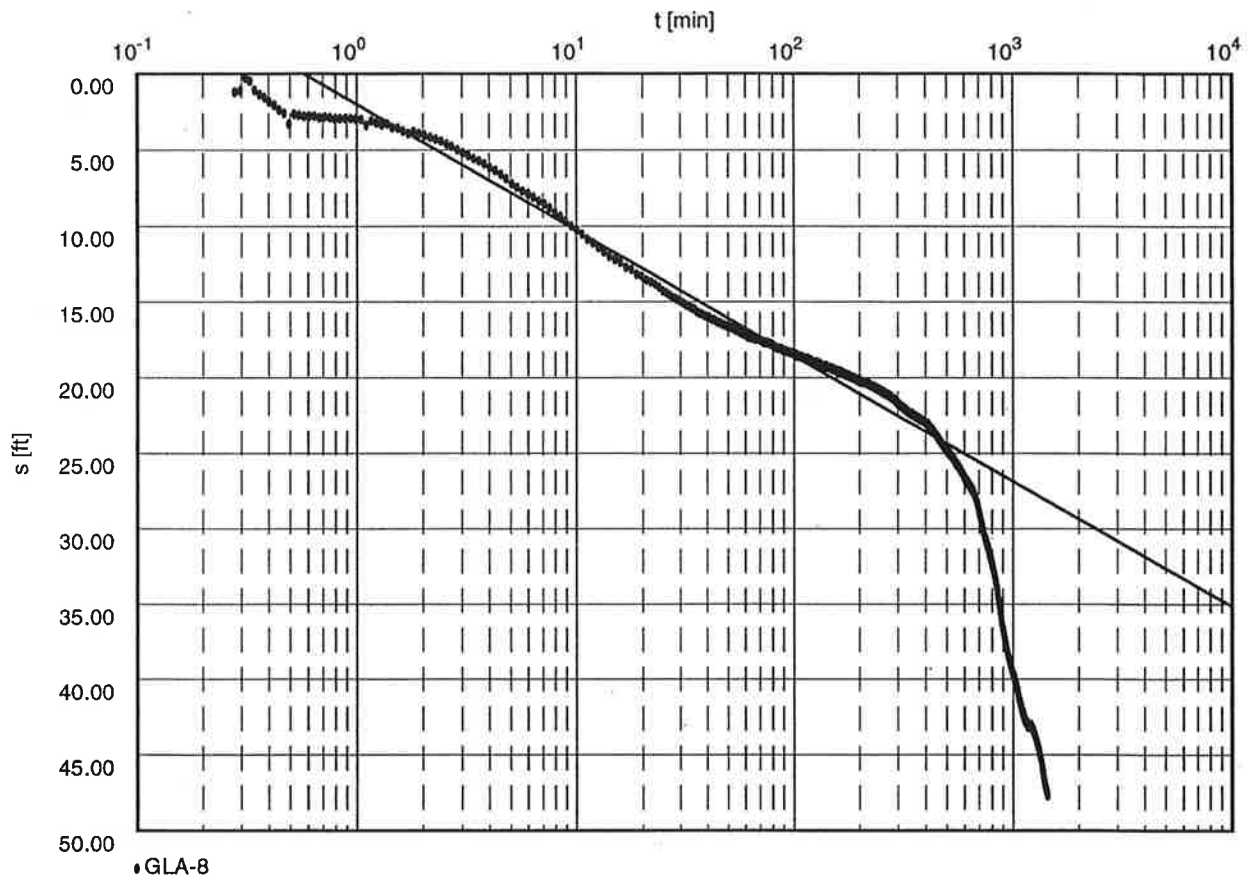
Evaluated by: wbl

Pumping Test No. 2

Test conducted on: 29.11.2000

GLA-8 (pumping well)

Discharge 2.00 U.S.gal/min



Transmissivity [ft<sup>2</sup>/min]:  $5.90 \times 10^{-3}$

Storativity:  $7.63 \times 10^{-3}$

**GeoLogic Associates**  
1360 Valley Vista Drive  
Diamond Bar, California  
(909) 860-3448

Pumping test analysis  
Theis analysis method  
Unconfined aquifer

Date: 08.12.2000 Page 1

Project: Gregory Canyon Landfill

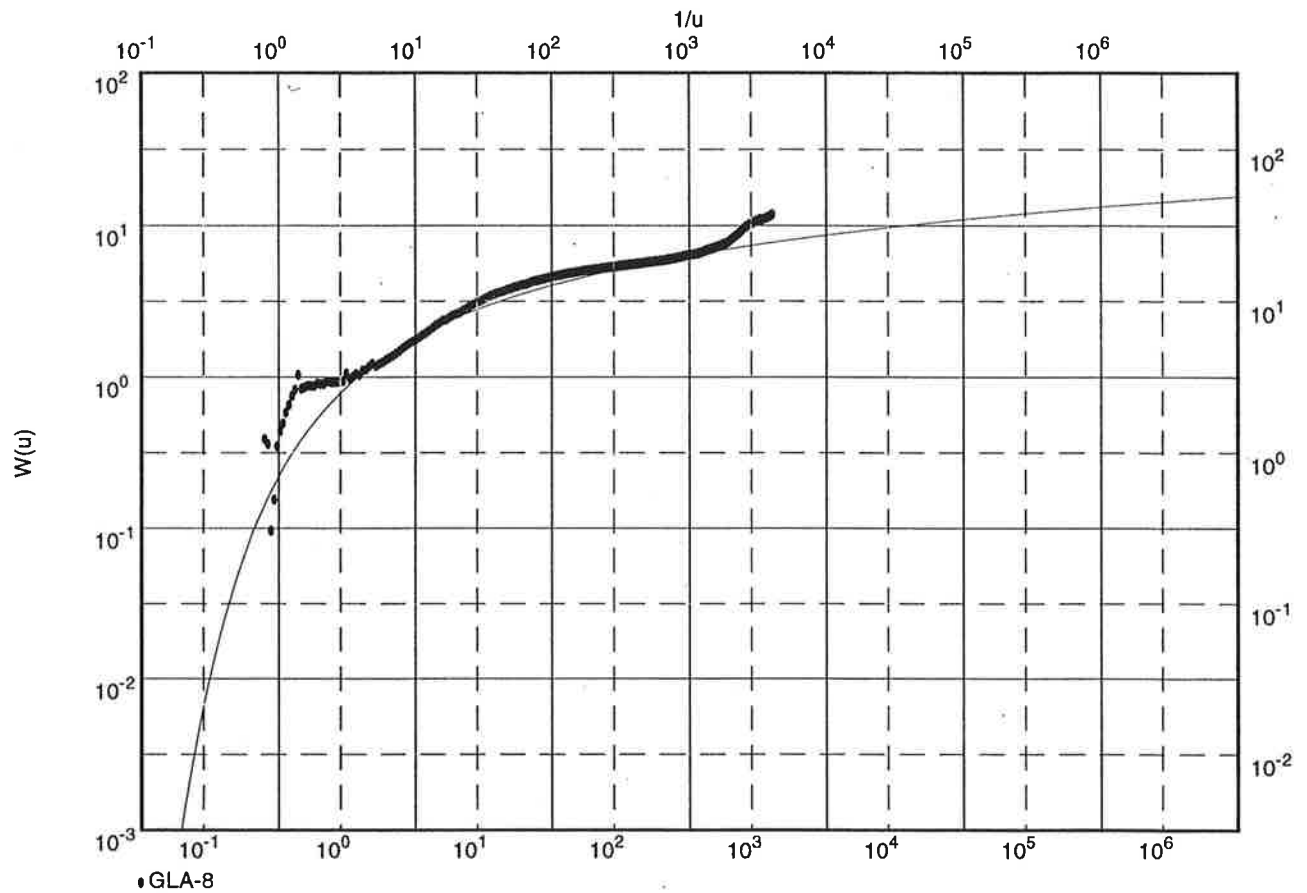
Evaluated by: wbl

Pumping Test No. 2

Test conducted on: 29.11.2000

GLA-8 (pumping well)

Discharge 2.00 U.S.gal/min



Transmissivity [ft<sup>2</sup>/min]:  $6.72 \times 10^{-3}$

Hydraulic conductivity [ft/min]:  $6.22 \times 10^{-5}$

Aquifer thickness [ft]: 108.00

**GeoLogic Associates**  
 1360 Valley Vista Drive  
 Diamond Bar, California  
 (909) 860-3448

Pumping test analysis  
 Time-Drawdown-method after  
**COOPER & JACOB**  
 Unconfined aquifer

Date: 08.12.2000 Page 1

Project: Gregory Canyon Pump Test

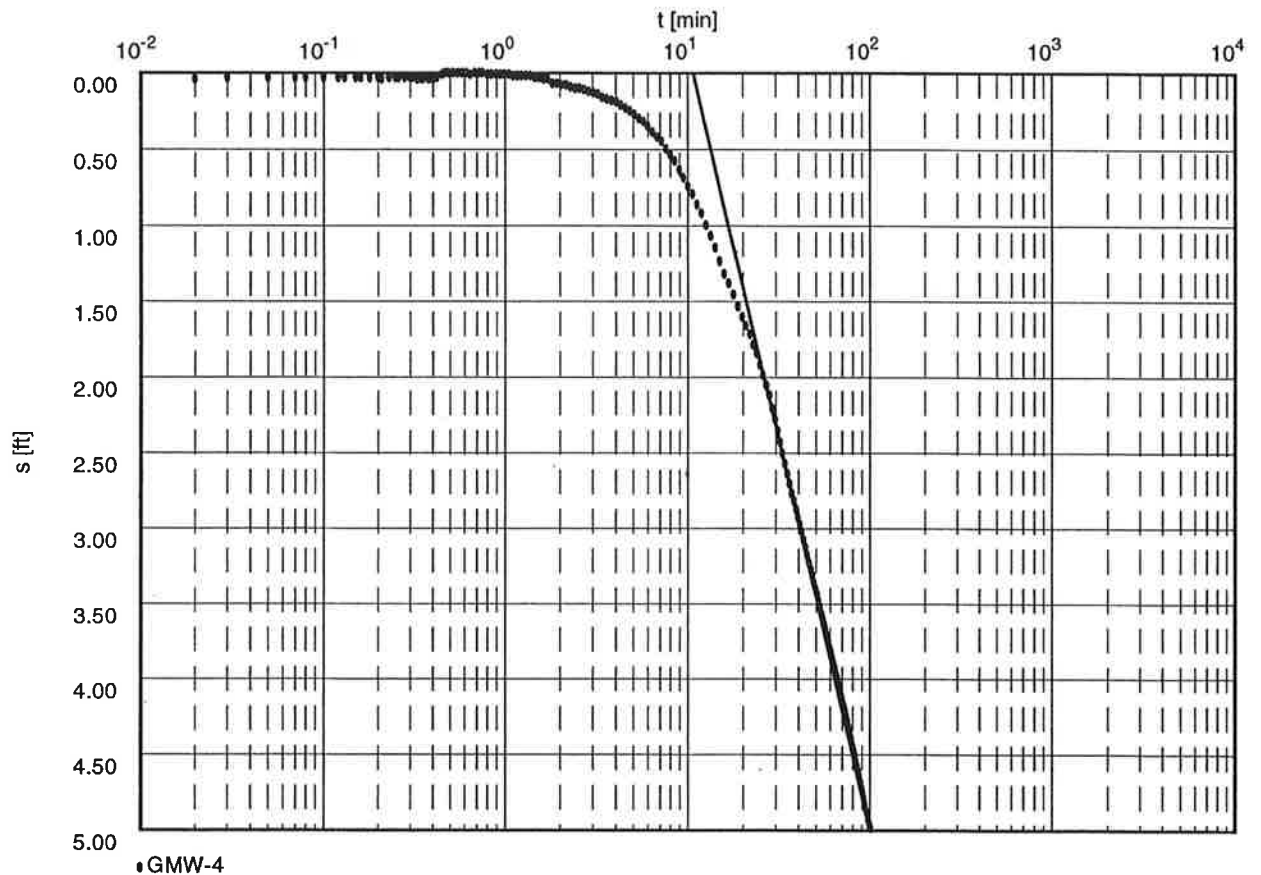
Evaluated by: wbl

Pumping Test No. 2

Test conducted on: 29.11.2000

GMW-4 (observation)

Discharge 2.00 U.S.gal/min



Transmissivity [ $\text{ft}^2/\text{min}$ ]:  $9.47 \times 10^{-3}$

Hydraulic conductivity [ $\text{ft}/\text{min}$ ]:  $2.06 \times 10^{-4}$

Aquifer thickness [ft]: 46.00



**GeoLogic Associates**  
 1360 Valley Vista Drive  
 Diamond Bar, California  
 (909) 860-3448

Pumping test analysis  
 Time-Drawdown-method after  
**COOPER & JACOB**  
 Confined aquifer

Date: 08.12.2000 Page 1

Project: Gregory Canyon Pump Test

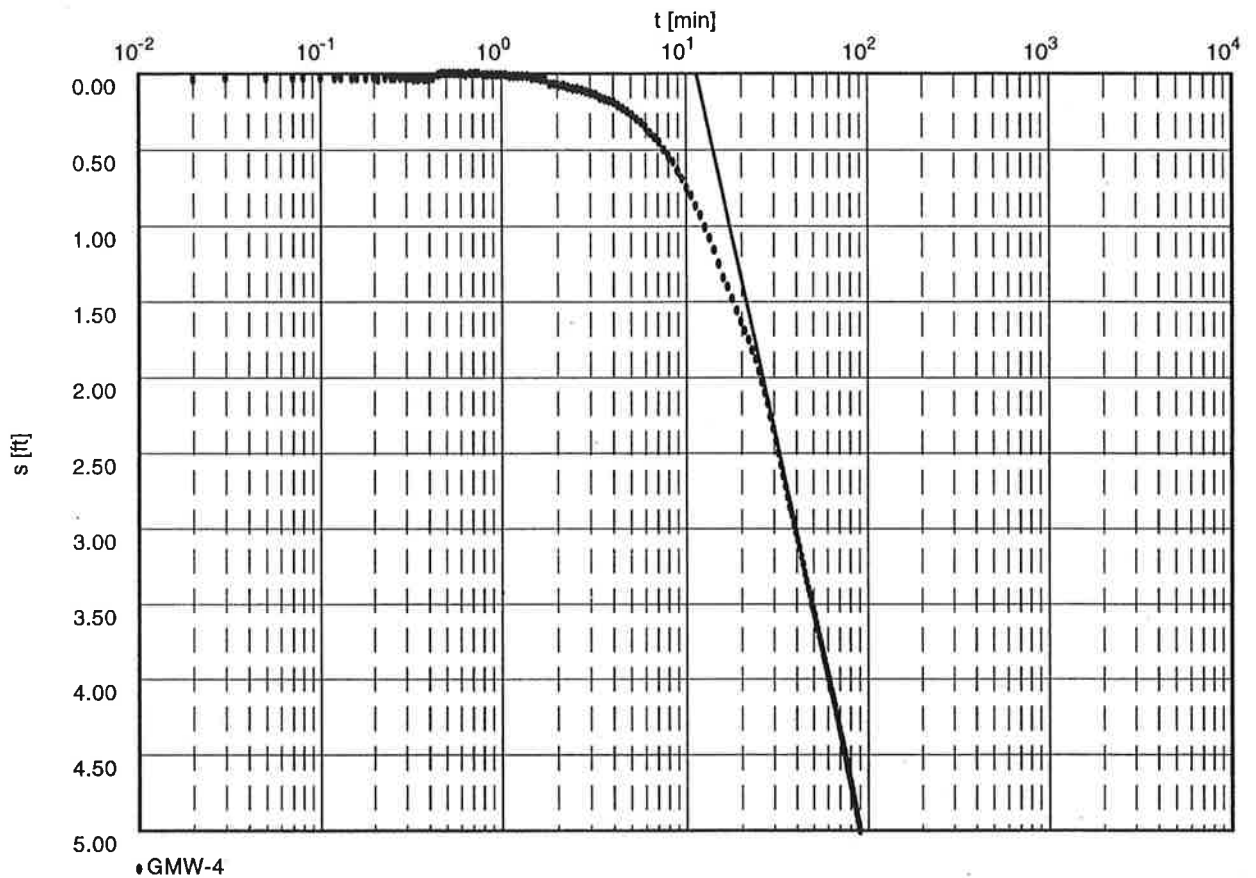
Evaluated by: wbl

Pumping Test No. 2

Test conducted on: 29.11.2000

GMW-4 (observation)

Discharge 2.00 U.S.gal/min



Transmissivity [ $\text{ft}^2/\text{min}$ ]:  $8.84 \times 10^{-3}$

Storativity:  $1.00 \times 10^{-3}$

**GeoLogic Associates**  
 1360 Valley Vista Drive  
 Diamond Bar, California  
 (909) 860-3448

Pumping test analysis  
 Time-Drawdown-method after  
**COOPER & JACOB**  
 Unconfined aquifer

Date: 08.12.2000 Page 1

Project: Gregory Canyon Pump Test

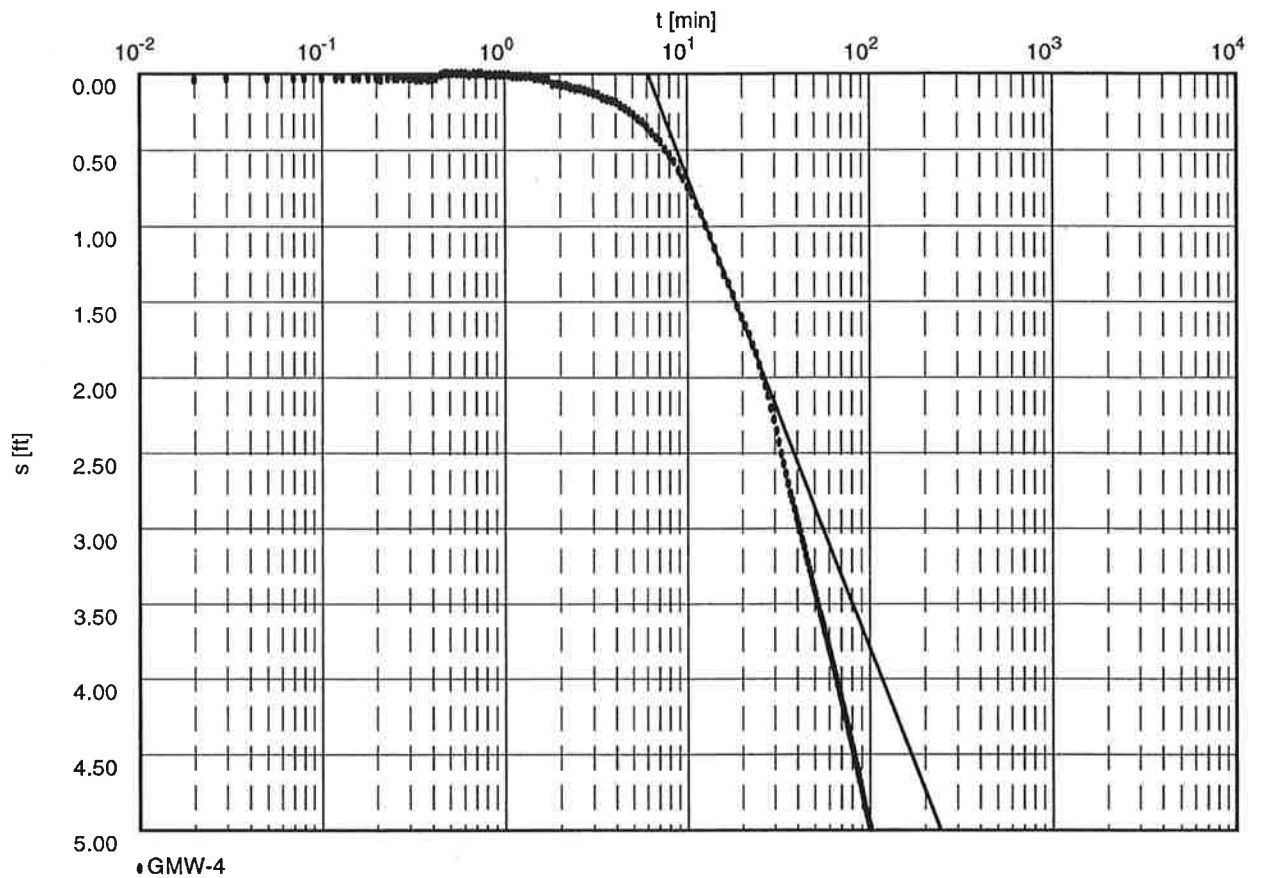
Evaluated by: wbl

Pumping Test No. 2

Test conducted on: 29.11.2000

GMW-4 (observation)

Discharge 2.00 U.S.gal/min



Transmissivity [ft<sup>2</sup>/min]:  $1.56 \times 10^{-2}$

Hydraulic conductivity [ft/min]:  $3.41 \times 10^{-4}$

Aquifer thickness [ft]: 46.00

**GeoLogic Associates**  
 1360 Valley Vista Drive  
 Diamond Bar, California  
 (909) 860-3448

Pumping test analysis  
 Time-Drawdown-method after  
**COOPER & JACOB**  
 Confined aquifer

Date: 08.12.2000 Page 1

Project: Gregory Canyon Pump Test

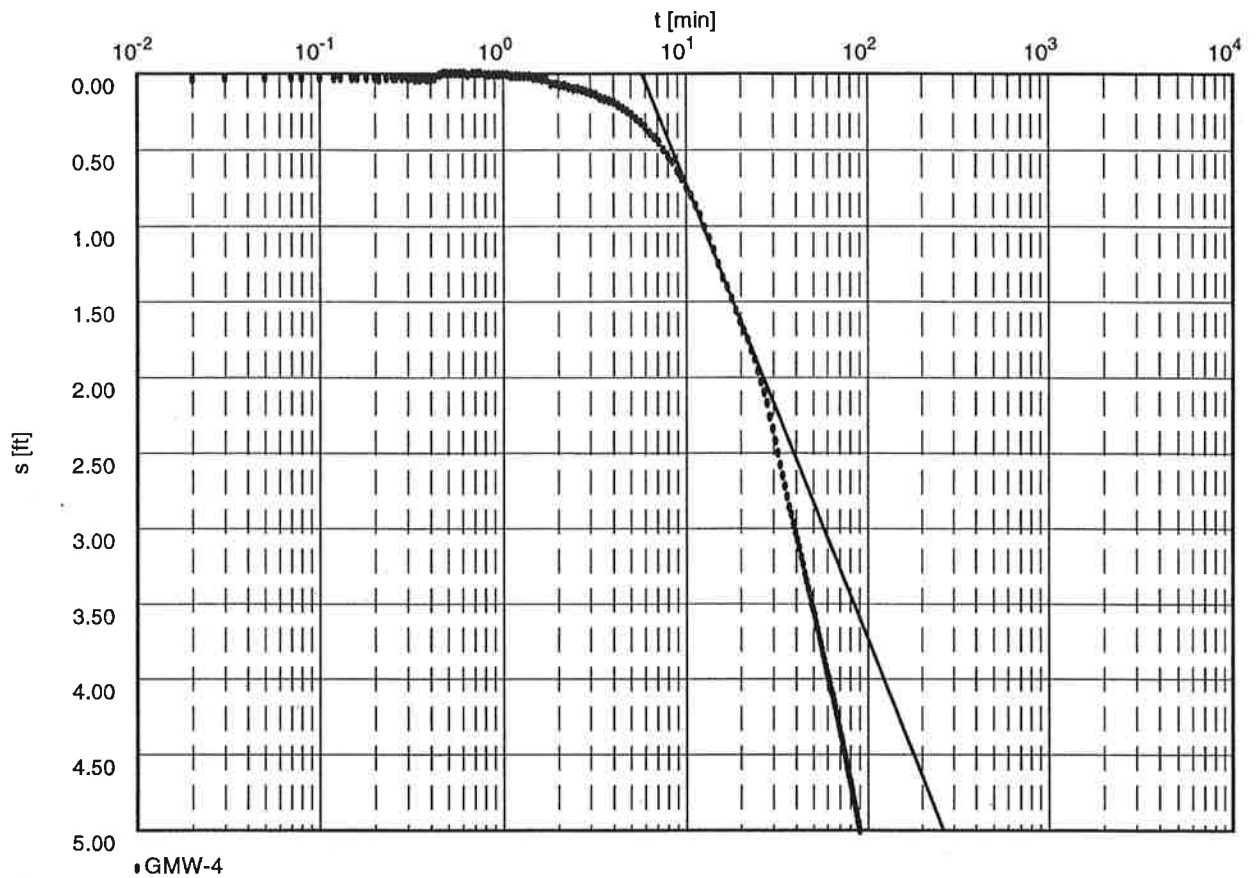
Evaluated by: wbl

Pumping Test No. 2

Test conducted on: 29.11.2000

GMW-4 (observation)

Discharge 2.00 U.S.gal/min



Transmissivity [ft<sup>2</sup>/min]:  $1.62 \times 10^{-2}$

Storativity:  $9.37 \times 10^{-4}$

**GeoLogic Associates**  
1360 Valley Vista Drive  
Diamond Bar, California  
(909) 860-3448

Pumping test analysis  
Theis analysis method  
Unconfined aquifer

Date: 08.12.2000 Page 1

Project: Gregory Canyon Pump Test

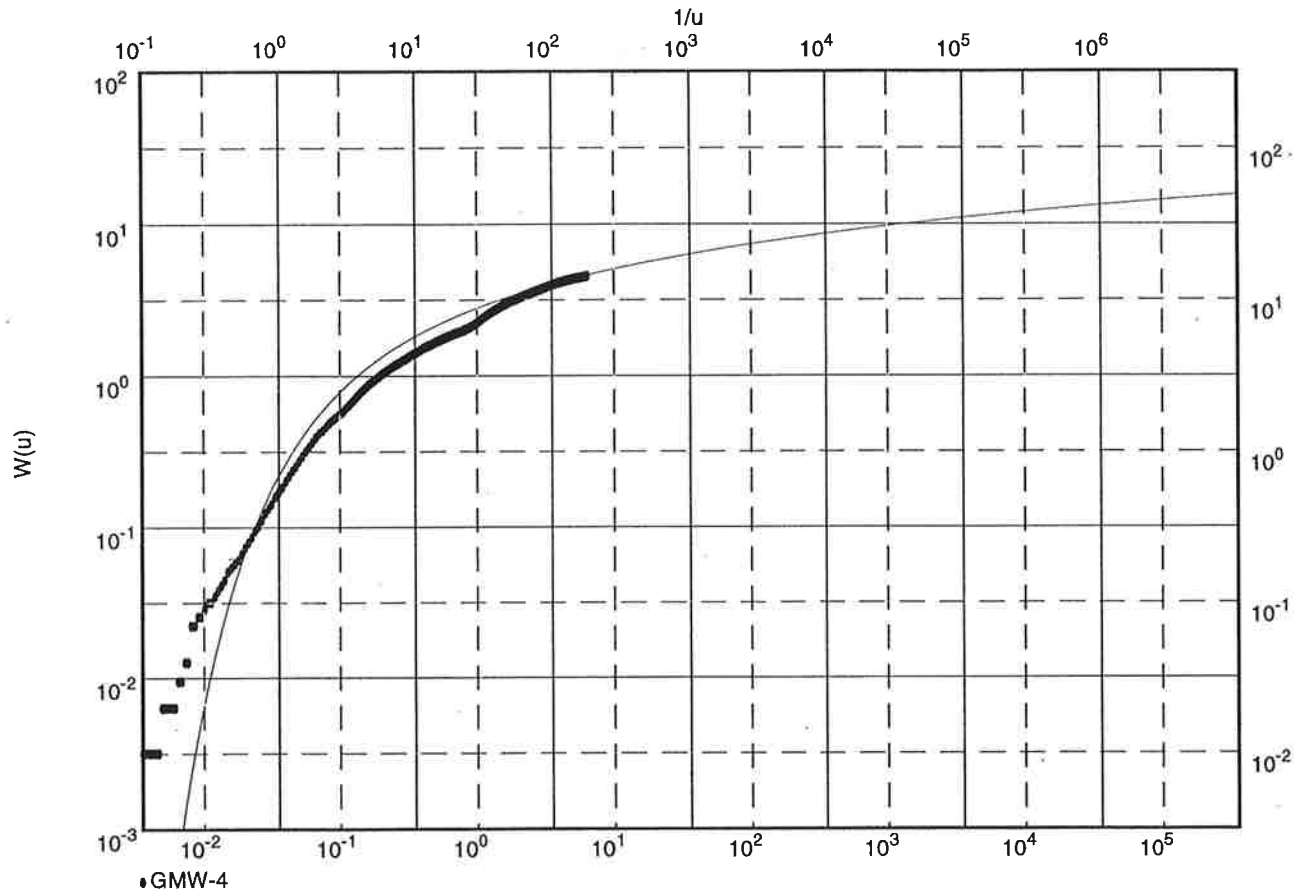
Evaluated by: wbl

Pumping Test No. 2

Test conducted on: 29.11.2000

GMW-4 (observation)

Discharge 2.00 U.S.gal/min



Transmissivity [ $\text{ft}^2/\text{min}$ ]:  $6.72 \times 10^{-3}$

Hydraulic conductivity [ $\text{ft}/\text{min}$ ]:  $1.46 \times 10^{-4}$

Aquifer thickness [ $\text{ft}$ ]: 46.00

**GeoLogic Associates**  
1360 Valley Vista Drive  
Diamond Bar, California  
(909) 860-3448

Pumping test analysis  
Distance-Drawdown-method after  
COOPER & JACOB  
Unconfined aquifer

Date: 12.12.2000 Page 1

Project: Gregory Canyon Pump Test

Evaluated by: wbl

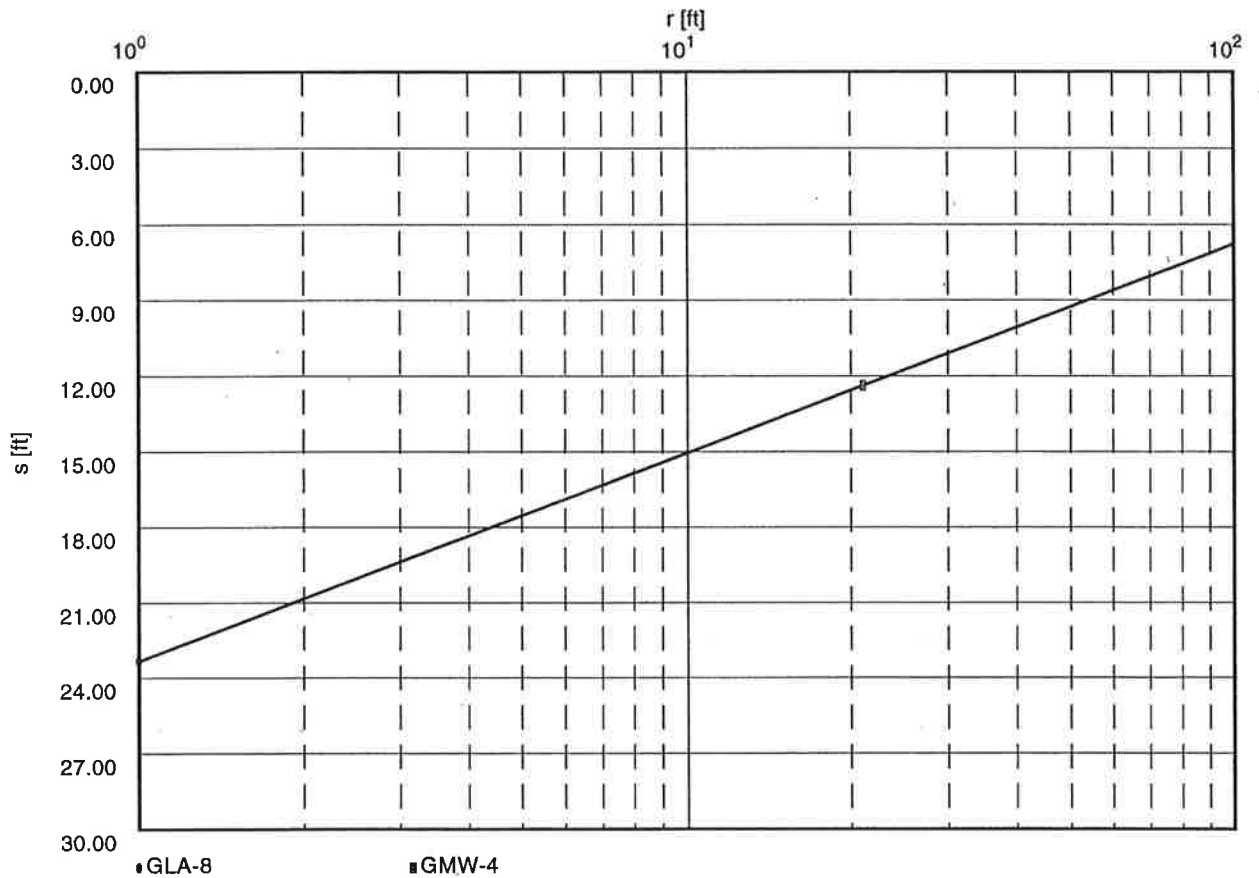
Pumping Test No. 2

Test conducted on: 11.29.2000

GLA-8 (pumping well)

Discharge 2.00 U.S.gal/min

Analysis at time (t) 600.00 min



Transmissivity [ft<sup>2</sup>/min]:  $1.18 \times 10^{-2}$

Hydraulic conductivity [ft/min]:  $1.09 \times 10^{-4}$

Aquifer thickness [ft]: 108.00

**GeoLogic Associates**  
1360 Valley Vista Drive  
Diamond Bar, California  
(909) 860-3448

Pumping test analysis  
Distance-Drawdown-method after  
COOPER & JACOB  
Unconfined aquifer

Date: 12.12.2000 Page 1

Project: Gregory Canyon Pump Test

Evaluated by: wbl

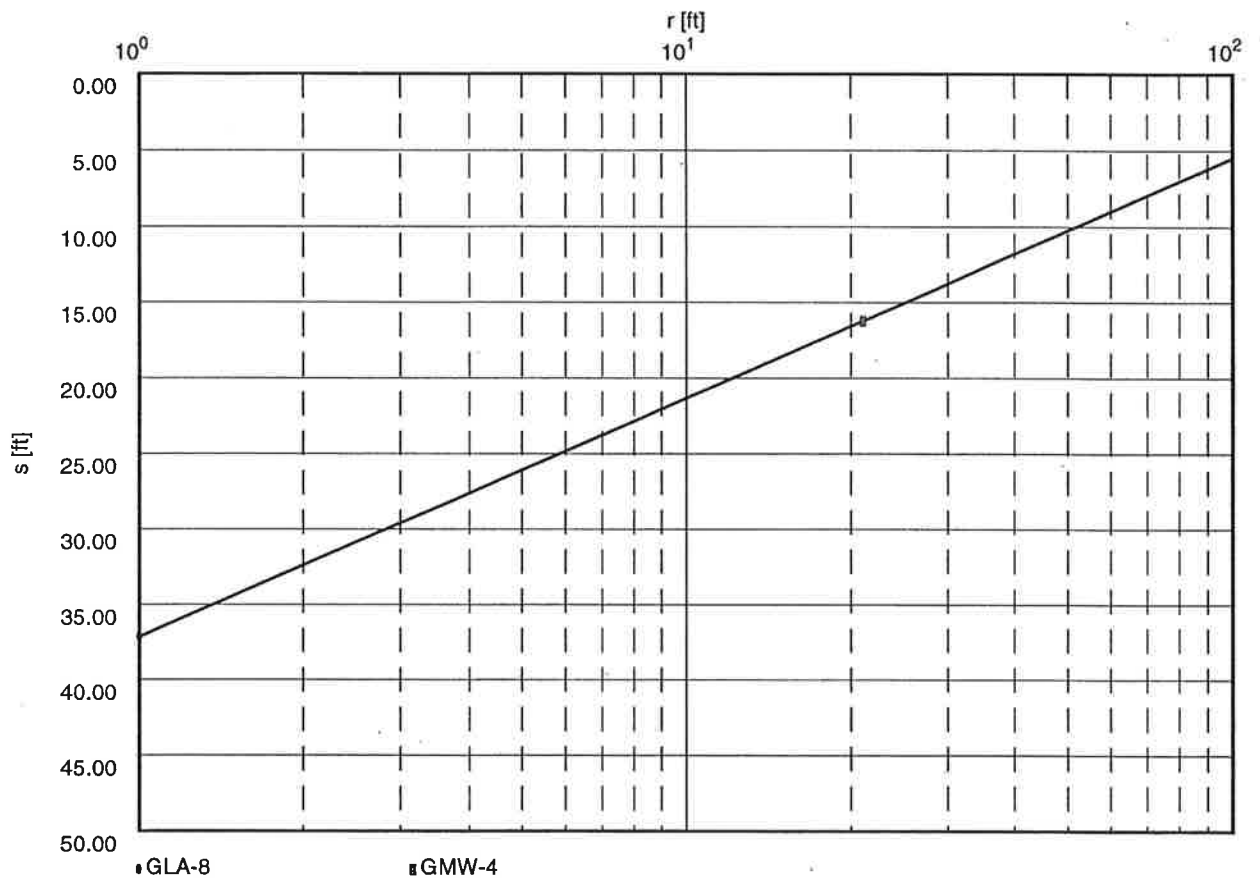
Pumping Test No. 2

Test conducted on: 11.29.2000

GLA-8 (pumping well)

Discharge 2.00 U.S.gal/min

Analysis at time (t) 1440.00 min



Transmissivity [ft<sup>2</sup>/min]:  $6.18 \times 10^{-3}$

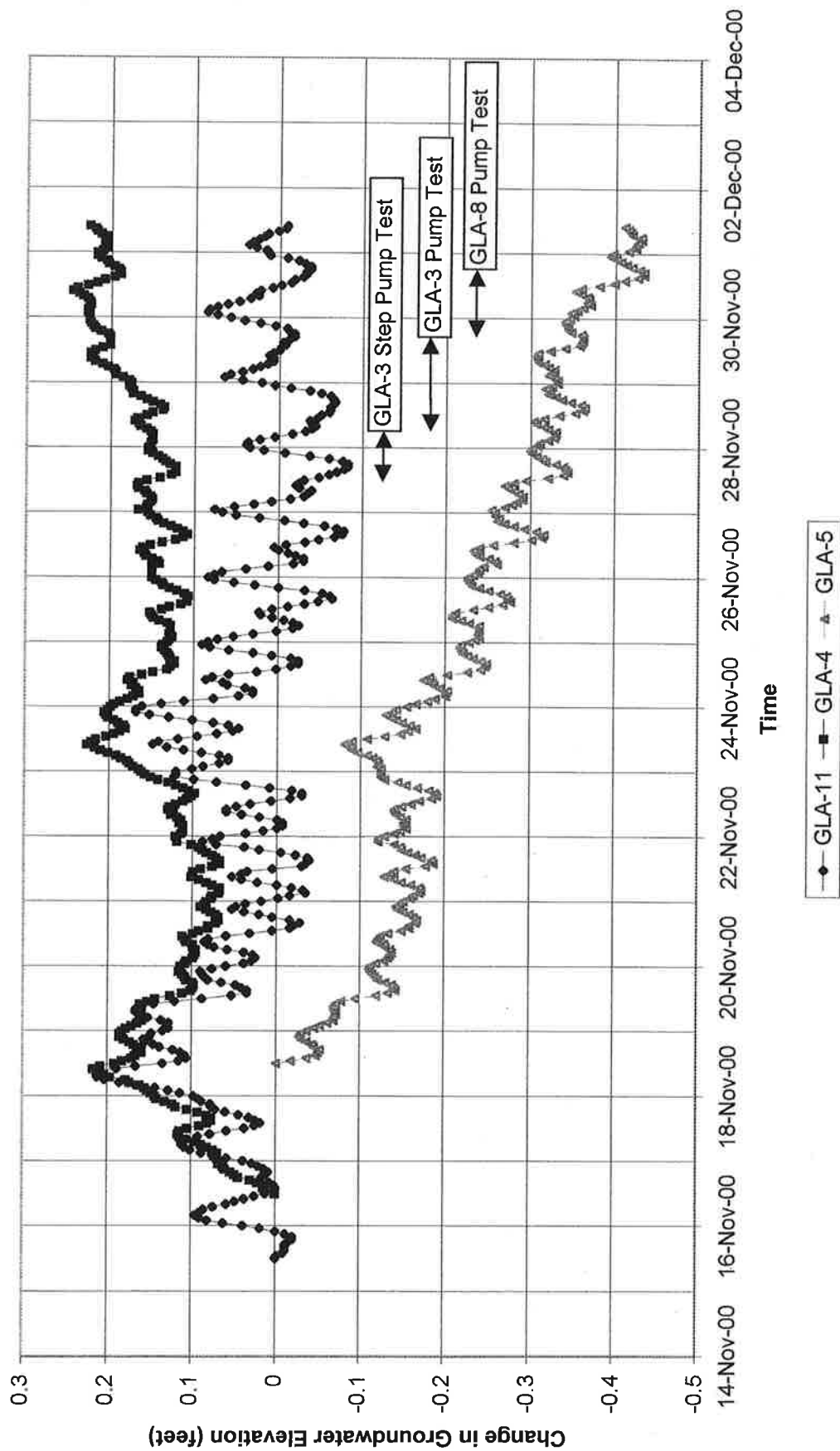
Hydraulic conductivity [ft/min]:  $5.72 \times 10^{-5}$

Aquifer thickness [ft]: 108.00

**APPENDIX C**

**FAR FIELD WELLS**

**Gregory Canyon Landfill**  
**Change in Groundwater versus Time**  
**Wells GLA-4, GLA-5, and GLA-11**





**APPENDIX D**

**AQUIFER PUMPING TESTS**  
**TECHNICAL SPECIFICATIONS**

**TABLE D-1  
GREGORY CANYON LANDFILL  
AQUIFER PUMPING TESTS  
TECHNICAL SPECIFICATIONS**

Test	Data Logger	Pumping Well Name	Pump Type	Depth of Pump (feet below ground surface / feet below water table)	Pumping Rate (gallons/minute)	Transducer Type	Observation Well GMW-1			Observation Well GLA-13		
							(Distance from Pumping Well)	Depth of Transducer Below Groundwater	Transducer Type	(Distance from Pumping Well)	Depth of Transducer Below Groundwater	Transducer Type
GLA-3 Step #1	Hermit 3000	GLA-3	3" Grundfos Elec. Sub. Pump	145 / 120	3	In Situ 100 psi pressure transducer	51	61	In Situ 30 psi pressure transducer	200	13	In Situ 30 psi pressure transducer
GLA-3 Step #2	Hermit 3000	GLA-3	3" Grundfos Elec. Sub. Pump	146 / 120	5.5	In Situ 100 psi pressure transducer	51	61	In Situ 30 psi pressure transducer	200	13	In Situ 30 psi pressure transducer
GLA-3 Step #3	Hermit 3000	GLA-3	3" Grundfos Elec. Sub. Pump	147 / 120	10	In Situ 100 psi pressure transducer	51	61	In Situ 30 psi pressure transducer	200	13	In Situ 30 psi pressure transducer
GLA-3 Step Recovery	Hermit 3000	GLA-3	NA	148 / 120	NA	In Situ 100 psi pressure transducer	51	61	In Situ 30 psi pressure transducer	200	13	In Situ 30 psi pressure transducer
GLA-3 Long Term Pump Test	Hermit 3000	GLA-3	3" Grundfos Elec. Sub. Pump	149 / 120	10	In Situ 100 psi pressure transducer	51	61	In Situ 30 psi pressure transducer	200	13	In Situ 30 psi pressure transducer
GLA-3 Long Term Recovery Test	Hermit 3000	GLA-3	NA	150 / 120	NA	In Situ 100 psi pressure transducer	51	61	In Situ 30 psi pressure transducer	200	13	In Situ 30 psi pressure transducer
Test	Data Logger	Pumping Well Name	Pump Type	Depth of Pump (feet below ground surface / feet below water table)	Pumping Rate (gallons/minute)	Transducer Type	Observation Well GMW-4					
							(Distance from Pumping Well)	Depth of Transducer Below Groundwater	Transducer Type	(Distance from Pumping Well)	Depth of Transducer Below Groundwater	Transducer Type
GLA-8 Long Term Pump Test	Hermit 3000	GLA-8	3" Grundfos Elec. Sub. Pump	225 / 156	2	In Situ 100 psi pressure transducer	21	33	In Situ 30 psi pressure transducer			
GLA-8 Long Term Recovery Test	Hermit 3000	GLA-8	NA	225 / 156	NA	In Situ 100 psi pressure transducer	21	33	In Situ 30 psi pressure transducer			
GLA-8 High Q Pump Test	Hermit 3000	GLA-8	3" Grundfos Elec. Sub. Pump	222 / 156	17.7 / 6.25	In Situ 100 psi pressure transducer	21	33	In Situ 30 psi pressure transducer			